FEBRUARY 1949

# American Foundryman

THE FOUNDRYMEN'S Own MAGAZINE

One of the important time-saving characteristics of this Moore Rapid Lectromelt furnace is the unique four point roof suspension. The tilted position of the size OPT Lectromelt furnace shows this construction principle advantageously. This system makes the removal, replacement and alignment of the roof very easy and very quick. The roof ring is suspended from sturdy outrigger arms by means of especially designed screw operated clips under the ring's top angle and supported at four points. This type of construction also securely locks the roof and superstructure in place.

Moore Rapid Lectromelt Furnaces are available in capacities ranging from 250 pounds to 100 tons. For full details, write today for the Lectromelt catalog.

**PITTSBURGH LECTROMELT FURNACE CORPORATION**

**PITTSBURGH 30, PENNSYLVANIA**

**MOORE RAPID**
*Lectromelt*
**FURNACES**

manufactured in: CANADA, Lectromelt Furnaces of Canada, Ltd., Toronto 2; ENGLAND, Birlec, Ltd., Birmingham; SWEDEN, Birlec Elektkeugnar A B, Stockholm; AUSTRALIA, Birlec Ltd., Sydney; FRANCE, Stein et Roubaix, Paris; BELGIUM, S. A. Belge Stein et Roubaix, Bressoux-Liege; SPAIN, General Electrica Espanola, Bilbao; ITALY, Forni Stein, Genoa.

# CROWN HILL

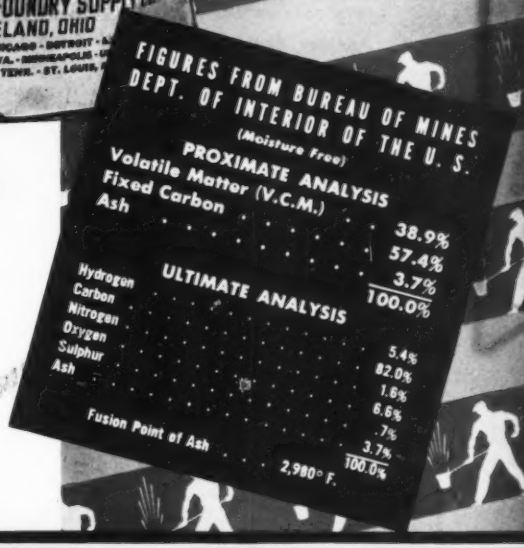
MORE...

MORE, MORE AND MORE...

FOUNDRYMEN CHOOSE

CROWN HILL

SEACOAL




## The Seacoal of Accepted Reliability

*What makes Crown Hill such a popular seacoal?*

**Quality** . . . Crown Hill's high volatile induces quick combustibility, quicker escape of gas and steam, better finish, lower cleaning costs, fewer defects.

**Popularity** . . . Foundrymen far and wide have used Crown Hill for many years. They know by experience how good Crown Hill really is.

**Manufacturer** . . . Made by the friendly friend of the foundries, The Federal Foundry Supply Co., a good company with which to do business.

*Test Crown Hill Seacoal Facing in your foundry.*

## THE FEDERAL FOUNDRY SUPPLY COMPANY

4600 East 71st Street · Cleveland 5, Ohio

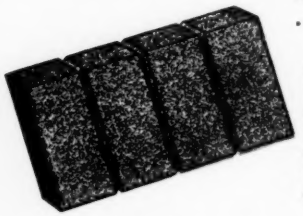
Seacoal Plants
CROWN HILL, W. VA. · CHICAGO · CHATTANOOGA, TENN. · DETROIT · MILWAUKEE · NEW YORK · ST. LOUIS · RICHMOND, VA. · UPTON, WYO.

IN THESE CITIES: The Foundry Supply Co., Inc., 606 South Third St., Minneapolis 15, Minn.

# "What a Whale of a difference clean metal makes in castings!"

Famous Cornell Cupola Flux has proved its ability as a metal cleanser so effectively that leading foundries have placed it among the "musts" in casting production, for clean metal means *more uniform, denser grained castings,* and *easier machining.* Furthermore, *its reduction of sulphur is very noticeable.*

Another feature of Famous Cornell Cupola Flux that is greatly appreciated: Cupolas are kept cleaner, drops are cleaner and labor for maintenance is practically nil.



**SCORED BRICK FORM**
***. . . the easiest to use.***
***. . . saves labor.***

No weighing. No measuring. You simply toss Famous Cornell Flux into cupola for each ton charge of iron or break off one to three briquettes (quarter sections) for smaller charges.

**Write for Bulletin 46-B**

## *The* CLEVELAND FLUX *Company*

**1026-1036 MAIN AVENUE, N. W., CLEVELAND 13, OHIO**

*Manufacturers of Iron, Semi-Steel, Malleable, Brass, Bronze, Aluminum and Ladle Fluxes—Since 1918.*

*Pour Clean Metal and Get Better Castings..*

Use

# *Famous* CORNELL CUPOLA FLUX

FAMOUS FLUXES Trade Mark Registered

**Write for Bulletins**

### *Famous* CORNELL ALUMINUM FLUX

**Produces clean, tough castings. No spongy or porous spots even when more scrap is used. Thinner yet stronger sections are poured: Castings take a higher polish. NO FUMES! Exclusive formula prevents obnoxious gases. Metal does not cling to dross.**

### *Famous* CORNELL BRASS FLUX

**Makes metal pure and clean, even when dirtiest brass turnings or sweepings are used. Produces castings which withstand high pressure tests and take a beautiful finish. Saves considerable tin and other expensive metals. Crucible and furnace linings are preserved.**

### *Famous* CORNELL LADLE FLUX

**Place a few ounces in bottom of ladle, then tap cupola. Metal is thoroughly cleansed, foreign impurities are easily skimmed off. Ladles are kept clean, there is less patching and increased ladle life. Metal temperatures are retained during transfer to molds.**

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FEBRUARY, 1949

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*February, 1949*

***Official publication of American Foundrymen's Society***

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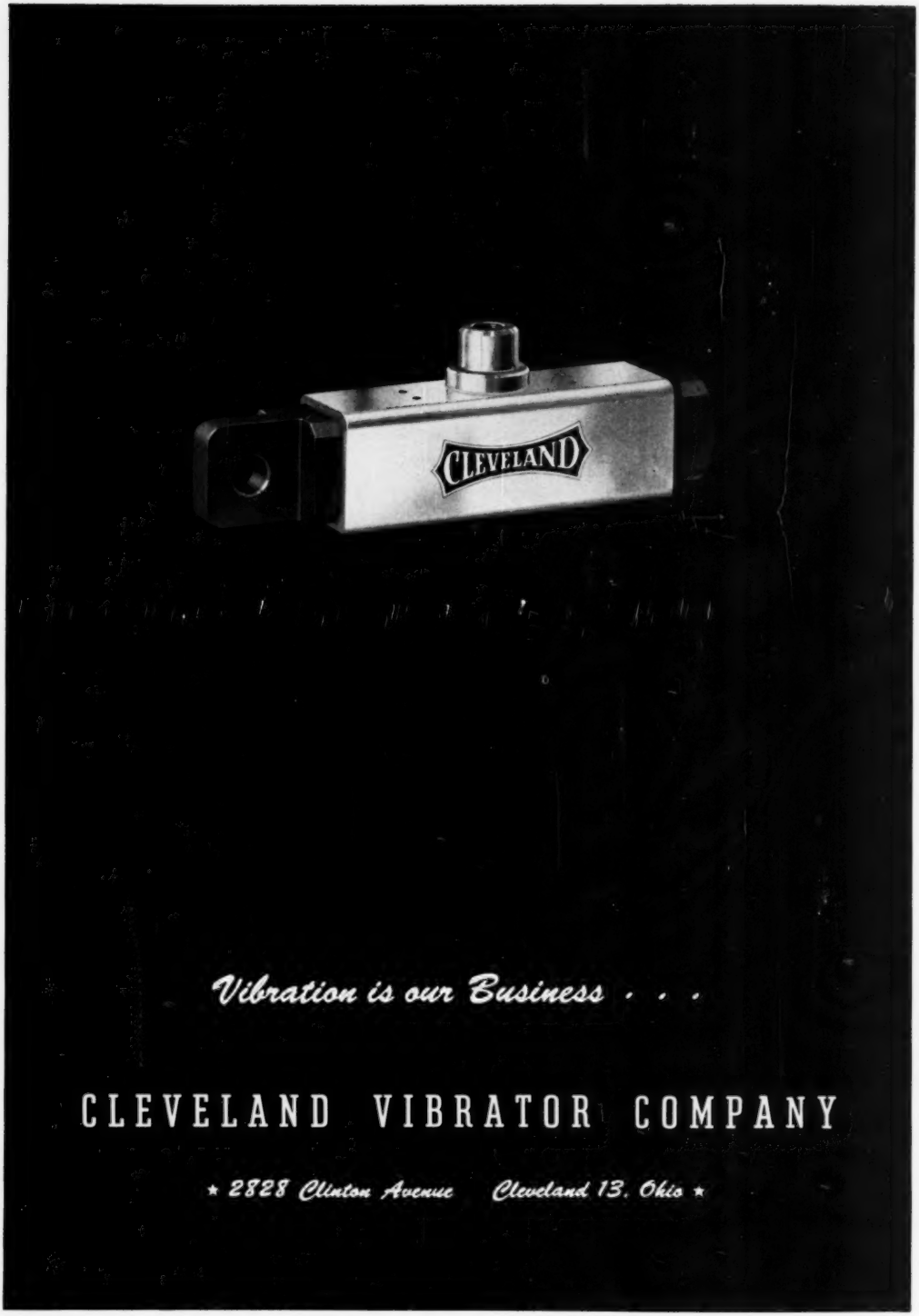
AMERICAN FOUNDRYMAN is indexed regularly by Engineering Index, Inc.

*The American Foundrymen's Society is not responsible for statements or opinions advanced by authors of papers printed in its publication.*

## This Month's Cover

In double match plate molding all steps in making the cope and drag are performed simultaneously. When striking off, the molder holds a piece of sheet metal between the mold halves to prevent sand from falling between them. Used primarily for small castings requiring few or no cores, the double match plate molding method was developed several years ago by one of the larger malleable plants to increase production and to lower costs. Tools, controls and motion path have been developed following the principles of motion time analysis.

Published monthly by the American Foundrymen's Society, Inc., 222 W. Adams St., Chicago 6. Subscription price in United States, Canada and Mexico, $3.00 per year; foreign, $6.00 per year. Single copies, 50c. Entered as second class matter July 22, 1938, under Act of March 3, 1879, at the post office, Chicago, Illinois.

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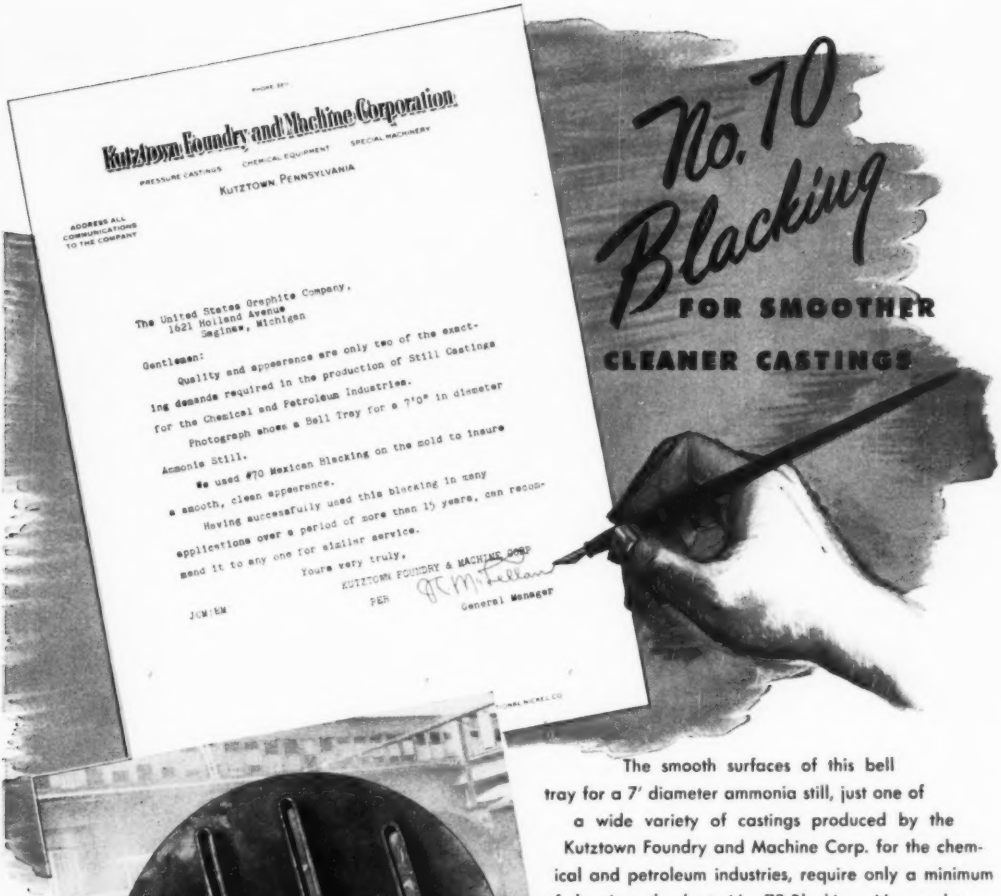
Kutztown Foundry and Machine Corporation
PRESSURE CASTINGS CHEMICAL EQUIPMENT SPECIAL MACHINERY
KUTZTOWN, PENNSYLVANIA
ADDRESS ALL COMMUNICATIONS TO THE COMPANY
The United States Graphite Company,
1621 Holland Avenue
Saginaw, Michigan
Gentlemen:
Quality and appearance are only two of the exact-
ing demands required in the production of Still Castings
for the Chemical and Petroleum Industries.
Photograph shows a Bell Tray for a 7'0" in diameter
Ammonia Still.
We used #70 Mexican Blacking on the mold to insure
a smooth, clean appearence.
Having successfully used this blacking in many
applications over a period of more than 15 years, can recom-
mend it to any one for similar service.
Yours very truly,
KUTZTOWN FOUNDRY & MACHINE CORP.
JCM:EM
PER
General Manager
No. 70 Blacking
FOR SMOOTHER
CLEANER CASTINGS

The smooth surfaces of this bell tray for a 7' diameter ammonia still, just one of a wide variety of castings produced by the Kutztown Foundry and Machine Corp. for the chemical and petroleum industries, require only a minimum of cleaning—thanks to No. 70 Blacking. No wonder Kutztown writes, recommending the use of No. 70 Blacking. This versatile mold coating penetrates deeply into sand surfaces to form a hard coat which turns out smoother, cleaner castings. It is economical and easy to use. No. 70 can be sifted dry through a cloth bag in treating green sand molds, for it draws sufficient moisture to bond to the sand; or it can be mixed with water to make an excellent wet blacking which assures a hard coat with maximum sand penetration for light and medium weight dry sand, skin dried and loam molds. It is also used by many production foundries to dip small baked cores which need extra protection under intense metal conditions.

- No. 70 Blacking, used by Kutztown in many applications for 15 years and preferred as a general purpose blacking by many other leading foundries, will help you to produce cleaner castings with less trouble and expense. Write for complete particulars.

**THE UNITED STATES GRAPHITE COMPANY • SAGINAW, MICHIGAN**
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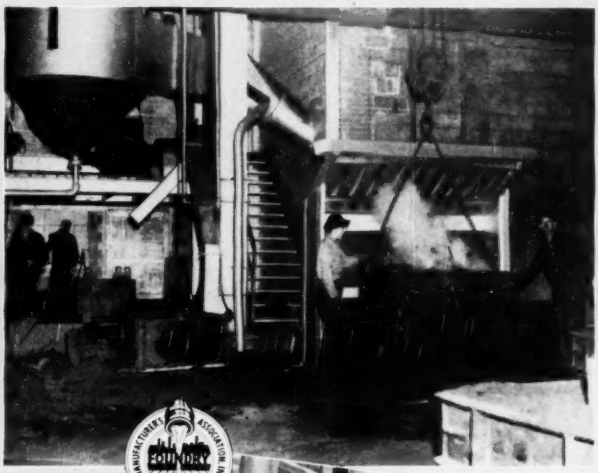
# SCHNEIBLE DUST CONTROL and VENTILATION

## *PAYS FOR ITSELF* 4 WAYS

Small Uni-Flo Hood on foundry shake out—note overhead installation of dust collector and usable floor space. Short duct work saves in initial outlay and power



**FRESH OUTSIDE AIR** gives clean comfortable working conditions, thus reducing labor turnover.

**NO SMOKE AND DUST** eliminates abrasive and corrosive elements thereby lengthening life of motors and other expensive facilities.

**BETTER VISIBILITY AND GREATER COMFORT** lessens accidents to workmen.

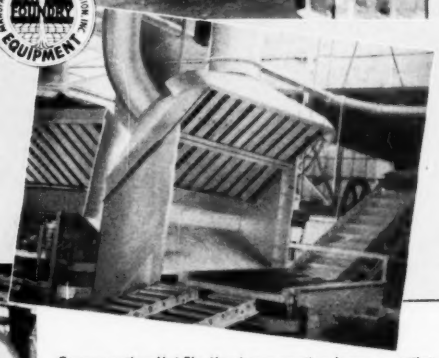
**OVERHEAD INSTALLATION** of Schneible Multi-Wash system allows valuable floor space to be used for production.

**Schneible Uni-Flo Dust Hoods are made in any practical size for any type of plant layout, adjacent to the process of operation where dust or fumes are created.**

**The Schneible Multi-Wash Collector can either be inside overhead or outside the building. Duct work does not interfere with normal plant operation.**

Compensating-Fractionating Uni-Flo Hood reduces dust collector cost and loss of plant heat.

(U. S. and Foreign Patents applied for.)



Compensating Uni-Flo Hood in operation lowers ventilating and heating costs while improving working conditions.

*Free*

Write for Standard Uni-Flo bulletin 410 and bulletins 47 and 48 covering all Uni-Flo types.

**CLAUDE B. SCHNEIBLE COMPANY**

**2827 Twenty-Fifth Street • Detroit 16, Michigan**

# USCO

**Producers of aluminum alloy ingot and deoxidizing shapes to exact specifications . . . the USCO trade mark is your assurance of quality backed by over 40 years of experience.**

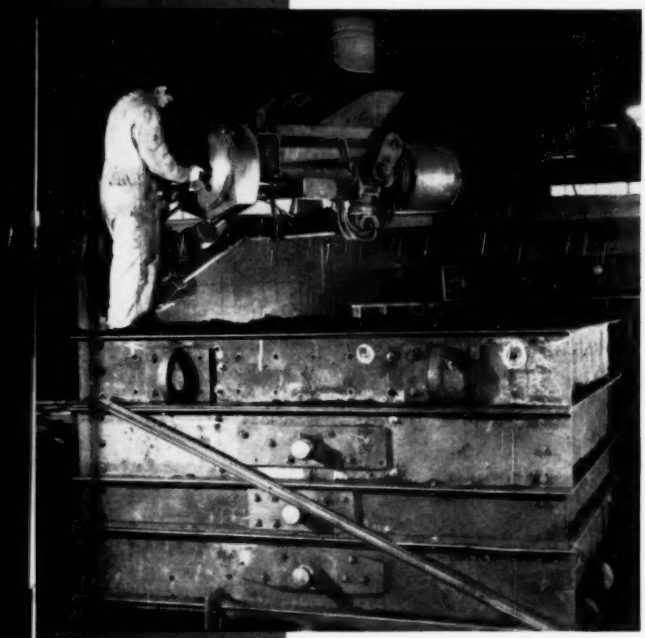
## USCO ALUMINUM

U. S. REDUCTION CO., East Chicago, Ind.

# ADVANCE FOUNDRY

## PREPARES, MULLS AND RAMS ITS SAND BY

# ADVANCED METHODS!

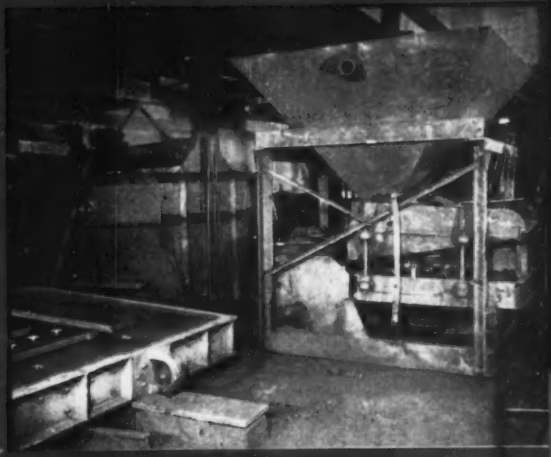


The Motive Jr. Sandslinger with its fast, uniform ramming saves from 1 to 2 days in making molds for large 30′ to 40′ long planer bed castings, weighing approximately 35,000 lbs.

Along the Sandslinger's 200 foot long track are flask and pit molds that vary greatly in size and shape. All are rammed by the Sandslinger, proving its versatility.

The Advance Foundry Co., Dayton, Ohio, obtains peak efficiency in ramming with a Motive Jr. Sandslinger, in sand mulling with a Speedmullor, and in sand preparation with a Preparator and several Screenarators. On many jobs, the Sandslinger at Advance has reduced the molding time approximately 50%. In making a mold for a large radial drill arm, weighing 15,000 lbs. in a flask 6½′ wide 6′ high and 23′ long, the Sandslinger saves 25 man-hours compared to the former air ramming method.

All of the facing and core sand used by Advance Foundry is mulled in this Model "40" Speedmullor . . . each batch being mulled in a 90 second cycle. The Speedmullor has a batch capacity of 5 cu. ft. and mulls an average of 120 batches each day.



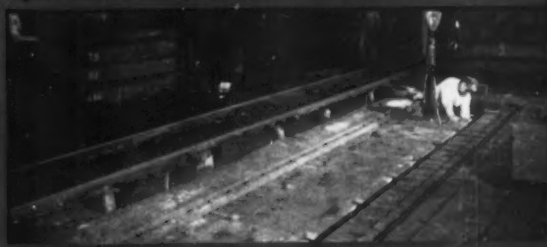
All the backing sand used by the Advance Foundry is thoroughly prepared in the B&P Sand Conditioner.

## SANDSLINGER, SPEEDMULLOR, SAND CONDITIONER AND SCREENARATOR BY

Advance Foundry is one of many hundreds of jobbing foundries who have reduced their molding cost and improved the quality of castings with the B&P better methods. With better sand and fast, uniform ramming, they have been able to greatly increase production and make more profits. There are foundries in your city or town that are also saving and producing more with Sandslingers, Speedmullors and other B&P equipment . . . let us make arrangements for you to see them in action. Write us today!

This large heater side mold at Advance Foundry is "just another job for the Sandslinger".

This large 27" long mold for [illegible] Engines frame is Sandslinger rammed.



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**"INGOT METALS OF TODAY"**

●

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Ajax Tombasil
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Ajax Manganese Bronze
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Ajax Golden Glow Yellow Brass
Ajax Nickel-Copper 50-50%
Ajax Manganese Copper
Ajax Aluminum Alloys
Ajax Phosphor Copper
Ajax Silicon Copper
Ajax Nickel Alloys
Ajax Phosphor Tin

**NOTE**

**"Proper Melting Decreases Foundry Losses," contains interesting data. Also, the booklet, "Nonferrous Ingot Metals of Today." Write for both of these. They are free.**

Successful foundrymen deoxidize or "clean up" molten metal by a scientific method worth using *as indicated:*

They use phosphorus . . expertly . . in the form of "Ajax Phosphor Copper" . . added as the crucible is removed from the furnace . . for virtually all brass and bronze alloys.

In notched waffle sections, or in shot form, Ajax 15% P-Cu does its work at .01% (1 oz. per 100 lbs.). Introduced, and having time to react when stirred with a whirling motion of the skimmer, it causes oxides to rise for effective removal by skimming from the surface. It is best to avoid phosphorus build-up from back stock.* . . If you use phosphorus these days, use Ajax Phosphor Copper (useful also in producing your phosphor bronze)

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ESTABLISHED 1880
PHILADELPHIA

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# That extra something can make a world of difference!

**With Penolyn Core Oil you get all 10 Important Features *PLUS* the Penola name . . . assurance of first class core oil quality. For high foundry efficiency you'll find it pays to specify Penolyn Core Oil.**

***1*** **UNIFORMITY** – rigid laboratory control; no "settling out" in drums or storage tanks.

***2*** **CONCENTRATED FORM** – high sand to oil ratio; economical.

***3*** **NO OBNOXIOUS ODOR**–during mixing, baking or pouring.

***4*** **NO SEEPAGE** – will not settle or drain to the bottom of sand mix or green, unbaked cores; baked cores will not stick to plate.

***5*** **NO CRUSTING OF GREEN MIX** – air dries slowly; green mix can be stored as long as 24 hours and still be usable.

***6*** **CLEAN WORKING** – eliminates frequent cleaning of core boxes; sharp draws.

***7*** **WIDE TEMPERATURE BAKING RANGE**–small and large cores can be baked at the same time; no burnt cores.

***8*** **POLYMERIZED FORMULATION**– maximum strength right through to center of baked core; dryer and plate side of equal hardness as exposed surfaces; no adherence.

***9*** **MINIMUM GAS** – less venting; fewer blows; lower casting losses.

***10*** **AMPLE COLLAPSIBILITY** – no hardened lumps to dig out; disintegrates while allowing metal to solidify and cool; fewer cracked castings.

***Our engineers are always ready to serve you. Write us about your core oil problem.***

CHICAGO
DETROIT
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**PENOLA INC.**

# FOR FASTER PRODUCTION OF...

# Better, Cleaner Castings

## STEEL, MALLEABLE, GREY IRON, NON-FERROUS USE...

# DELTA CORE & MOLD WASHES

**Three easy-to-understand reasons why more foundries use DELTA Core and Mold Washes . . .**

**1. MORE PERFECT CASTINGS . . .** **2. LOWER CLEANING ROOM COSTS . . .**

**3. LESS SCRAP IN MACHINING.**

## HERE'S WHY...

**a.** Delta Core and Mold Washes "Anchor" themselves by penetrating from 3 to 5 grains deep into the sand. This bond between the wash and the sand . . . a distinctive DELTA characteristic . . . produces an expansion-resisting coating essential to the production of finer finished castings.

**b.** The hot strength of Delta Core and Mold Washes increases with each degree of temperature rise from 1800°F to 3000°F providing maximum critical hot strength for all foundry applications.
The higher hot strength of DELTA Core and Mold Washes eliminates surface sand fissuring, excessive sand expansion and distortion.

**c.** No gas leakage through Delta Core and Mold washed surfaces. Gases produced by decomposition of organic binders in the core sand cannot leak through Delta Core and Mold washed surfaces to contact the molten metal. Only Delta Core and Mold Washes provide this unique and all-important insurance against defective castings resulting from core gas leakage. DELTA Core and Mold Washes insure more perfect castings with finer finished surfaces.

**DELTA CORE & MOLD WASH-BASE**
Mix with silica flour and water to produce finished wash.

**FOR STEEL**
STEELKOAT — Special Core and Mold Wash.

**FOR GREY IRON & MALLEABLE**
Grakoat — Blackoat — Hi-temp.

**FOR NON-FERROUS METALS**
Non-FerrusKoat.

**FOR ALL SAND CAST METALS**
THERMOKOAT — It's Plasti-Lastic.
PYROKOAT-Hi-Speed.

**FOR UNUSUALLY HIGH TEMPERATURE CONDITIONS**
Z-KOAT-High-fusion-temp wash.

• *Ask for a liberal working sample.*

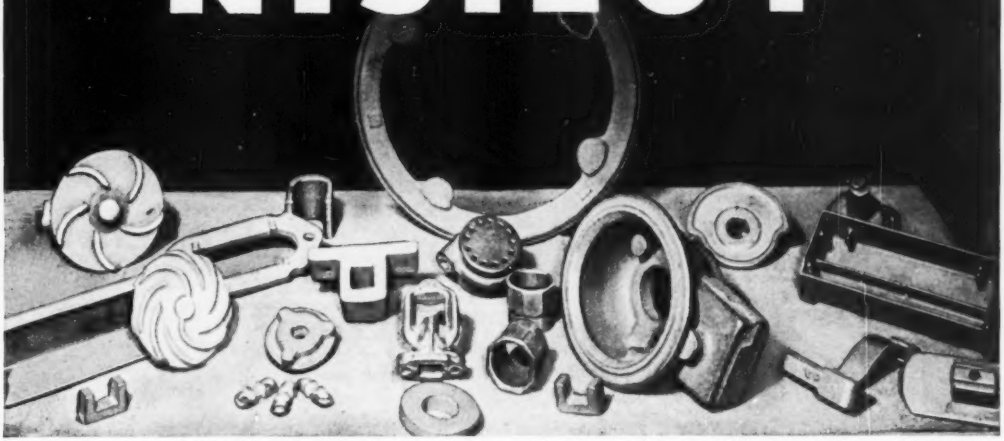
There is no "just as good" substitute for any DELTA Core and Mold Wash just as there is no substitute for DELTA'S scientific laboratory control of production which safeguards the quality and uniformity of all DELTA Foundry Products. DELTA Research laboratories developed, and pioneered the use of, Plastic-type Core and Mold Washes . . . and still leads the field in the development of new products for improved foundry practices.

# DELTA OIL PRODUCTS CO.

**MILWAUKEE 9, WISCONSIN**

SPECIFY THE ADDITION OF

# NISILOY*



Chilling and consequent machining difficulties were encountered by a foundry specializing in cast parts like these, designed with both heavy and light sections. Nisiloy, added to the ladle, assured ready machinability after many other experiments failed.

*for Better Machinability in* **GRAY IRON CASTINGS**

Casting users profit from use of Nisiloy . . . a new, powerful, positive inoculant that promotes better machinability. It contains about 60 per cent nickel, 30 per cent silicon, balance essentially iron.

Faster, easier, lower-cost finishing of gray iron castings may be attained because Nisiloy serves to eliminate localized hard areas or chilled (white) edges and surfaces . . . regardless of sharp variations in section thickness.

Get full information. Send for *your* free copy of a booklet that describes how the dense, gray, machinable structure secured with Nisiloy reduces machining time, tool wear, rejects and costs. Mail the coupon now.

*Trade mark of the International Nickel Company, Inc.

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TRADE MARK

The International Nickel Company, Inc.
Dept. A-F, 67 Wall Street, New York 5, N. Y.
Please send me your booklet entitled
"NISILOY" for GRAY IRON CASTINGS.

*Name*.....*Title*.....
*Company*.....
*Address*.....
*City*.....*State*.....

**THE INTERNATIONAL NICKEL COMPANY, INC.** 67 WALL STREET NEW YORK 5, N. Y.

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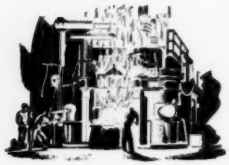

***Field Metallurgists*** — You can obtain the help of our trained metallurgists who render on-the-job assistance in the use of ferro-alloys. These men are qualified to suggest the grades and sizes of alloys best suited for your particular steel and practice.

***Laboratory Research***— You can benefit by the new alloys developed by our continuous laboratory research. Developments from this research include the low-carbon ferro-alloys, silicomanganese, SILCAZ alloy, calcium metal, calcium-silicon, and ferrocolumbium.

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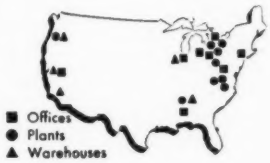


## ELECTROMET Ferro-Alloys and Metals

Information about these and other alloys and metals produced by ELECTROMET is contained in the booklet, "ELECTROMET Products and Service." Write for a copy.

**CHROMIUM** . . . Low-Carbon Ferrochrome (in all grades from 0.03% maximum to 2.00% maximum Carbon), Nitrogen-Bearing Low-Carbon Ferrochrome, High-Carbon Ferrochrome, SM Ferrochrome, Chromium Metal, CMSZ Mix, and other Chromium Alloys.

**VANADIUM** . . . Ferrovanadium in all grades, Vanadium Oxide, and Ammonium Metavanadate.

**COLUMBIUM** . . . Ferrocolumbium.

**MANGANESE** . . . Standard Ferromanganese, Low-Carbon and Medium-Carbon Ferromanganese, Low-Iron Ferromanganese, Manganese Metal, and other Manganese Alloys.

**SILICOMANGANESE** . . . Max. 1.50 and 2.00% Carbon Grades.

**TUNGSTEN** . . . Ferrotungsten, Tungsten Powder, and Calcium Tungstate Nuggets.

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**TITANIUM** . . . Silicon-Titanium and Manganese-Nickel-Titanium.

**CALCIUM** . . . Calcium-Silicon, Calcium-Manganese-Silicon, and Calcium Metal.

**"EM" BRIQUETS** . . . Silicon, Silicomanganese, Ferromanganese, and Chromium Briquets.

**ZIRCONIUM** . . . 12-15%, and 35-40% Zirconium Alloys, and Nickel-Zirconium.

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Ferro-Alloys and Metals

**Electro Metallurgical Division**
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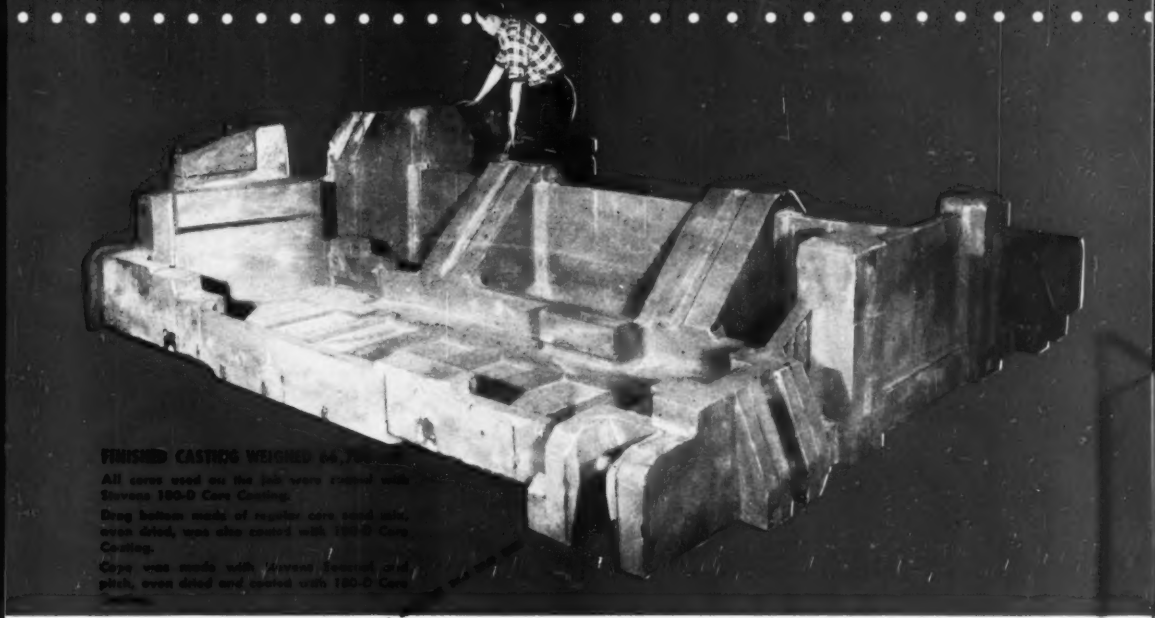
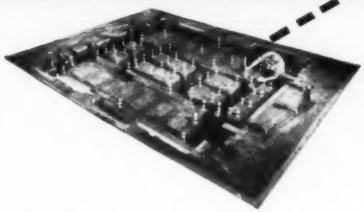
# No room for guess-work here!



FINISHED CASTING WEIGHED 64,700 LBS.
All cores used on the job were coated with Stevens 180-D Core Coating.
Drag bottom made of regular core sand skin, oven dried, was also coated with 180-D Core Coating.
Cope was made with Stevens Sea-coal and pitch, oven dried and coated with 180-D Core



## The Stevens "Job-Qualified" Foundry Facings used in producing this 33 ton Casting had to be just right!

The old saying, "never send a boy to do a man's work," was never more true than in the application of core and mold coatings to "special" casting jobs such as are regularly turned out by Central Iron Foundry Co. of Detroit.

The technical and highly specialized nature of such operations permits no room for guess-work in the proper application of foundry facings. Nor does it permit the least deviation in the quality of the materials used. For more than half a century Stevens "job-qualified" foundry facings have dependably met such exacting demands—are meeting them today.

The dependable *uniform quality* of all Stevens facings, is insured by rigid *laboratory control* every step of the way. Production volume of foundry facings warrants the purchase of ingredients in carload lots, where lowest possible material costs permit us to pass along savings reflected in the price of finished facings. Our modern mill operations are so completely mechanized as to virtually eliminate the human factor in producing these *quality-controlled* products.

Whenever and wherever recommended for your use, Stevens foundry facings will be *right—right* in quality, *right* in better job performance.

SINCE 1882 STEVENS EVERYTHING FOR THE FOUNDRY

LEADING MANUFACTURERS AND DISTRIBUTORS OF FOUNDRY FACINGS, EQUIPMENT AND SUPPLIES

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FOUNDRY EQUIPMENT AND SUPPLIES DIVISION

# Foundrymen who look at binders—

# without BLINDERS

## ...see these big reasons for using CYCOR* 110

IT PAYS to switch from the conventional binders to Cyanamid's improved synthetic resin binder, CYCOR 110, for sand cores. Just make this comparison yourself and see.

You'll find that . . .

CYCOR 110 bakes in faster time—at lower temperatures . . . produces more uniformly high-quality cores per oven.

You get unusually good collapsibility . . . with less cleaning required.

CYCOR 110 costs no more than standard binders, yet saves you money because you purchase only the neat synthetic resin, modifying it with fillers and extenders to meet your special requirements.

You'll find, in short, that CYCOR 110 is what you have been looking for. Write for further information. Plastics Department, American Cyanamid Company, 30-36 Rockefeller Plaza, New York 20, N. Y.

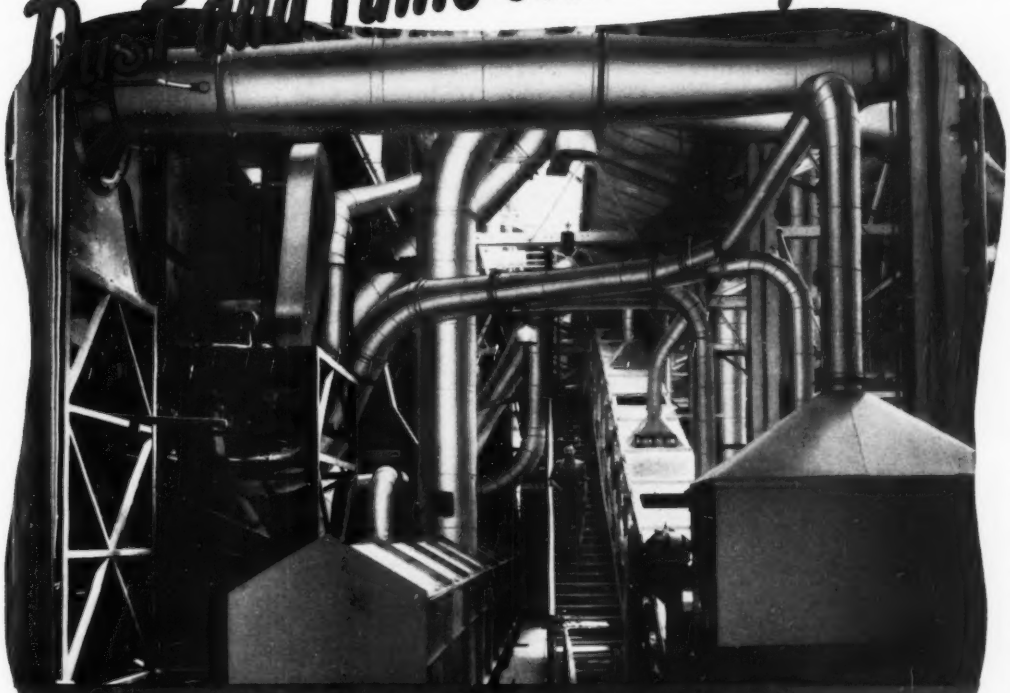
*Reg. U. S. Pat. Off.

AMERICAN *Cyanamid* COMPANY

PLASTICS DEPARTMENT

30-36 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

# Famous implement manufacturer selects KIRK & BLUM Dust and Fume Control Systems



*In the large photo, two mold cooling conveyors are shown to left and right of stairway.*

ON the mold cooling conveyor . . . over the production line shake-outs . . . on snagging and grinding machines and at other points in this modern foundry, you'll find KIRK & BLUM Dust and Fume Control Systems. Each was designed to help make this foundry as clean as any in the industry . . . "a good place to work."

Shown above are two views of KIRK & BLUM Dust and Fume Control Systems which provide "Clean Air . . . the invisible tool" in this plant of one of the world's largest farm implement manufacturers. Note the efficient piping arrangement, installed to AFS standards.

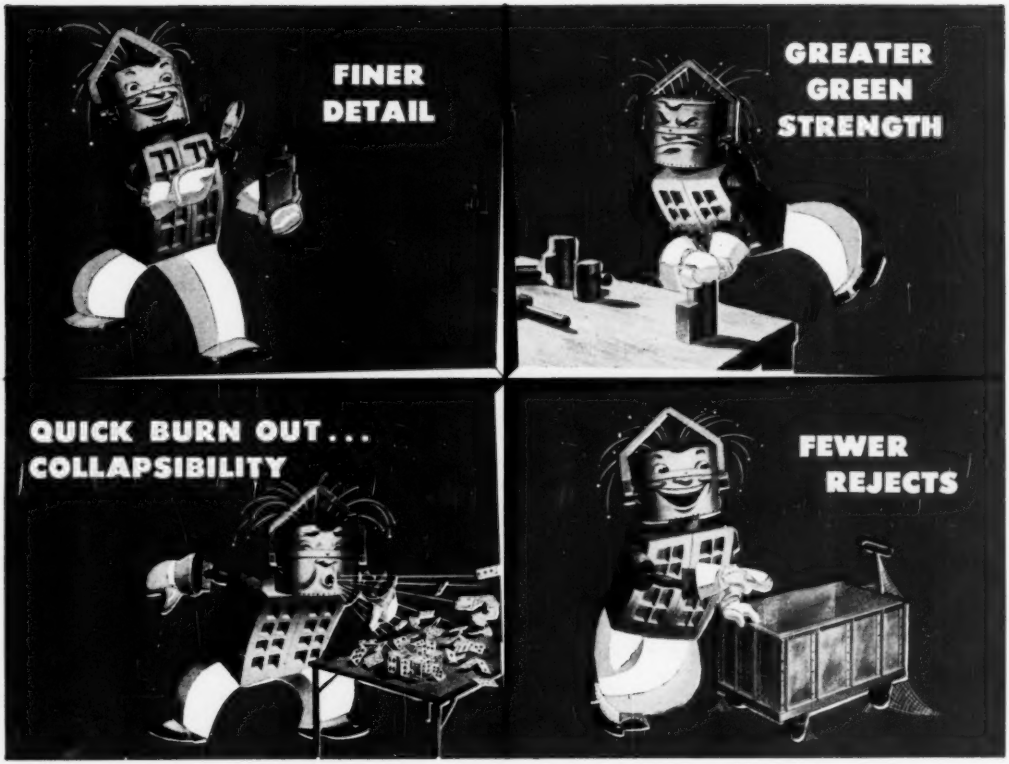
The various KIRK & BLUM Systems in this plant are but a few of thousands installed over a period of 40 years in almost every type of industry. Additional photos and data are shown in the free booklet "Dust Collecting Systems in Metal Industries," yours for the asking. The Kirk & Blum Mfg. Co., 2876 Spring Grove Ave., Cincinnati 25, Ohio.

*FOR CLEAN AIR . . . THE INVISIBLE TOOL*

**KIRK AND BLUM**

**DUST AND FUME CONTROL SYSTEMS**

# WHAT EVERY CORE-MAKER NEEDS AND WANTS:




YES — the qualities you need and want are yours in Krause's Cereal Binders—TRUSCOR (light weight) and AMERIKOR (heavy weight).

So why not take advantage of all these benefits by placing your next order with any of the distributors listed below or with us direct.

**CHAS. A. KRAUSE MILLING CO., MILWAUKEE 1, WISCONSIN**

*World's largest dry corn millers*

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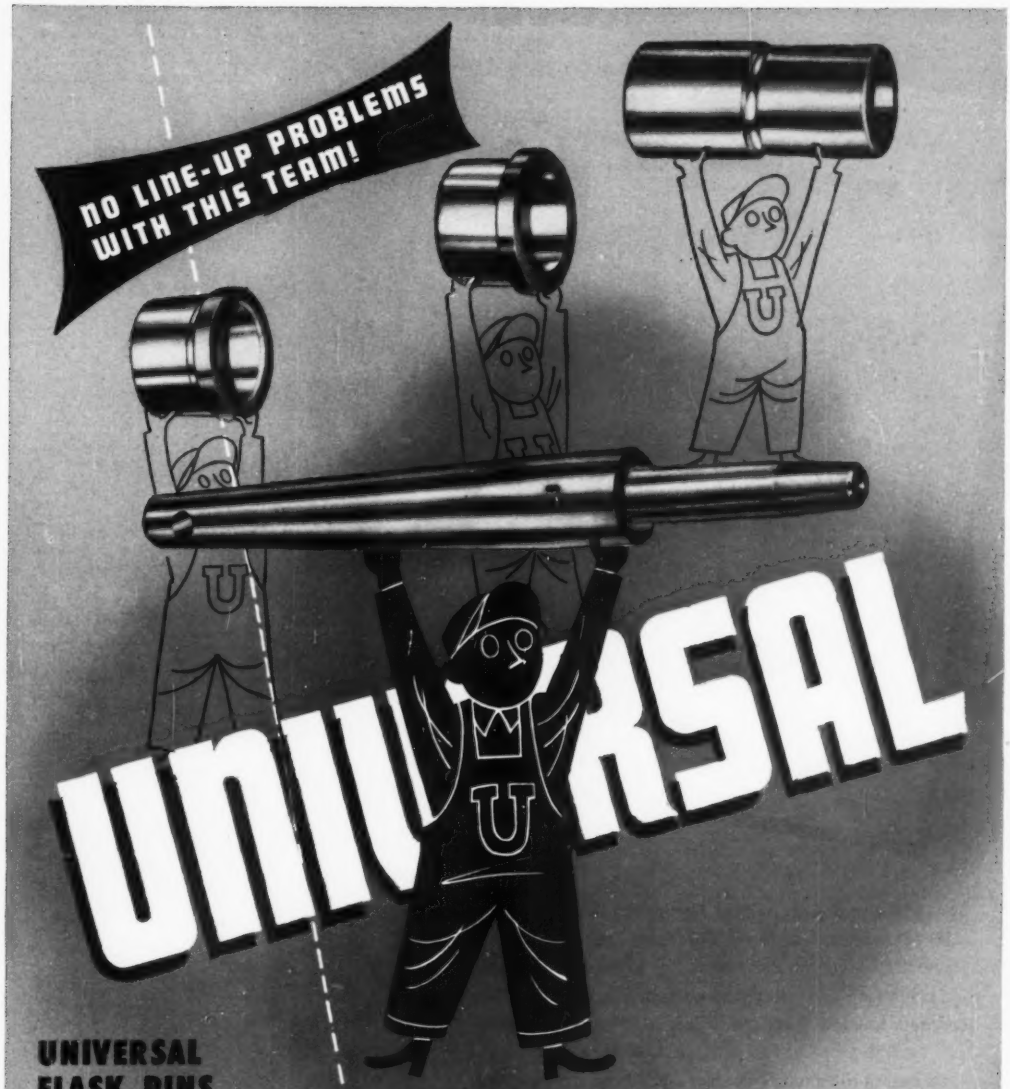
Detroit 26, Mich.
Frederic B. Stevens, Inc.
New Haven 11, Conn.
Western Industrial Supply Co.
Portland 14, Ore.




**UNIVERSAL FLASK PINS, BUSHINGS, and CLOSING PINS for perfect alignment of cope and drag**

Here is a team that has helped eliminate cope and drag problems in many foundries — Universal Flask Pins, Bushings and Closing Pins. Cope Bushings are quickly guided to the Drag Pins over tapered, loose-fitting Closing Pins which are quickly removed after assembly. Special design of Elongated Flask Bushing permits longitudinal expansion to compensate for metal heat, without affecting accurate alignment. Round, elongated, press fit and taper types for cast iron, steel, aluminum and magnesium flasks are available for immediate delivery in several sizes. Special types and sizes to order. Write for complete information.

**UNIVERSAL ENGINEERING COMPANY**
**FRANKENMUTH 12, MICHIGAN**

# ...ER UNIT *in our core room is highly satisfactory*

THE MARYLAND CAR WHEEL COMPANY
BOX 1604
BALTIMORE, MD

September 6, 1946

Mr. Bruce Simpson, President
National Engineering Company
549 West Washington Boulevard
Chicago, Illinois

Dear Sir:

It is always a great satisfaction to a management when they make a capital investment to find that it works out efficiently.

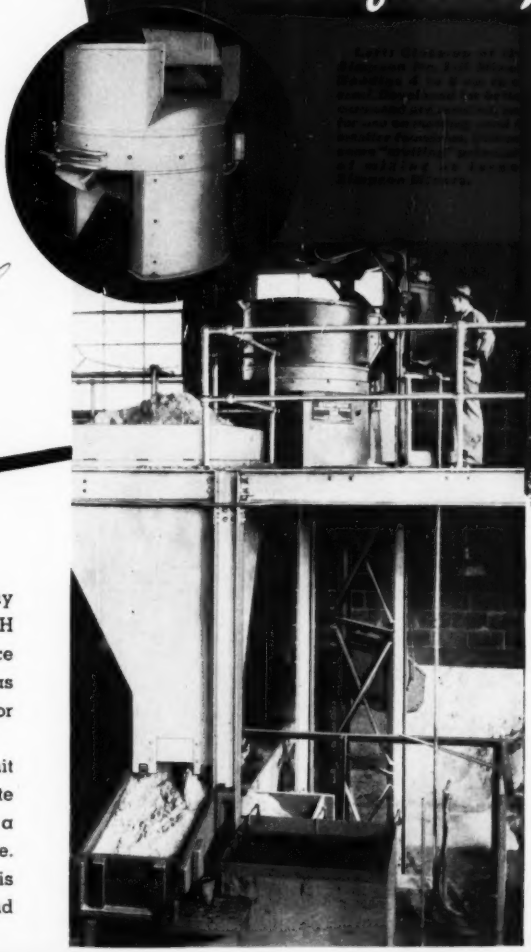
The installation of a Simpson Mixer unit, complete with loader hoist, in our new core room has been that type of installation and, since it was first started, it has been highly satisfactory in all regards.

This has been the result of the efficient engineering help that your organization gave us, when we planned the layout, and I am very glad to give your organization full credit for their share in the successful operation.

Very sincerely,

D. H. Sherwood
President

DHS:C



The Maryland Car Wheel Company, like so many other foundries, has found that their Simpson No. 1-H Mixer Unit gives them consistently satisfactory service . . . and since this letter was written, this company has ordered another Simpson Mixer, loader and aerator . . . further proof of Simpson performance.

Shown at the right is the No. 1-H Simpson Mixer Unit installed in the Maryland foundry core room, complete with National Bucket Loader and control panel . . . a highly efficient unit requiring a minimum of floor space.

The "efficient engineering help" mentioned above is yours for the asking . . . to help you obtain *better* sand *faster*, at *lower cost*. *Write for details.*

MANUFACTURER'S ASSOCIATION INC. FOUNDRY EQUIPMENT

## NATIONAL ENGINEERING COMPANY

**600 MACHINERY HALL BUILDING • CHICAGO 6, ILLINOIS**

Manufacturers and Selling Agents for Continental European Countries—The George Fischer Steel & Iron Works, Schaffhausen, Switzerland. For the British Possessions, Excluding Canada and Australia—August's Limited, Halifax, England. For Canada—Dominion Engineering Co., Ltd., Montreal, Canada. For Australia and New Zealand—Gibson, Battle & Co., Pty., Ltd. Sydney, Australia

# CASTINGS *Unlimited!*

A UNITED FRONT for the Foundry Industry is long past due.

Employer of nearly half a million Americans and producing six billions of dollars worth of products, the Industry has for its castings no powerful spokesmen but many influential detractors. Split by needless controversy among the various metal divisions, its markets are being eroded by organized competition of welding, forging and fabrication. With much of its products the output of very small shops, and nearly 50 per cent coming from captive plants with relatively disinterested managements, backers of castings have protested hopelessly while coordinated competitors move product after product from the mold to the torch, the forge and the roll.

Why doesn't the Industry fight back? Where are its talents and men? The answer lies in the 12 separate groups aiding the Foundry Industry, or segments of it—iron by the Gray Iron and the Malleable Founders' Societies; steel by the Steel Founders' Society and the Alloy Castings Institute; non-ferrous by the Non-Ferrous Founders' Society, the Aluminum and the Magnesium Associations; equipment and supplies by the Foundry Equipment and the Foundry Supply Manufacturers Associations; industry-wide special problems by the Foundry Educational Foundation, the National Founders' Association, and the American Foundrymen's Society.

None of these organizations speaks for the Castings Industry in *every* respect. And the total society expenditure of well over a million dollars a year is so diversified that the effect is dissipated and lost.

Division of responsibilities of these groups must not be allowed to continue. There should be a regrouping of the many special organizations and a pooling of their interests in an effort to develop the *market for castings*. The National Castings Council, made up of the presidents of all these societies, should provide an industry-wide program for advancement, unless we wish to see the smaller groups fail under pressure of economic readjustment.

Without swallowing up the identity of any single group, the National Castings Council can and should implement an Industry policy for developing new castings business where it does not now exist, rather than allow continued futile competition over what is available. To this end, resources—both financial and otherwise—can be pooled to do a real job in castings promotion, in research, in education, and in public relations. To this end, 12 separate staffs can be consolidated and commonly housed to provide more economical foundry organization membership, closer cooperation, and elimination of expensive duplications and conflicts.

Let there always be a tug-of-war between steel and iron. Let there always be healthy argument between all interested foundry groups. But let us close up our ranks and present a united front to the world.

Let us tell of the remarkable achievements of castings. Let us extol the casting process to every designer, to every engineer and to every student, so that all will know that in this most versatile of metalworking processes, there lies the answer to many of their problems. Let us give a rebirth to the only natural method of making the basic product of Industrial America—the metal casting.

BRUCE L. SIMPSON

*The opinions expressed in this editorial are those of the author, and not necessarily of the A.F.S. Board of Directors on which the author serves. The basic idea was presented before the National Castings Council at a meeting January 20, 1949, where it aroused considerable comment. Since adoption or rejection of such a plan must come from the Foundry Industry itself, and especially from top foundry management, discussion through correspondence is hereby invited.*—EDITOR.

# ST. LOUIS WELCOMES YOU

## To the *53rd Annual* A.F.S. CONVENTION

PRESAGING HEAVY ATTENDANCE, an early rush of applications for housing accommodations for the 53rd Annual Convention of the American Foundrymen's Society, to be held May 2-5 in St. Louis, has led the Hotels Reservation Bureau of that city to urge foundrymen who plan to attend the Convention to make immediate application. While there is expected to be an adequate number of rooms for Convention-goers, Bureau officials state that early application will insure a better selection of accommodations. All housing applications must be addressed to the St. Louis Hotels Reservation Bureau, 1420 Syndicate Trust Bldg., St. Louis 1, Mo.

The 53rd A.F.S. Foundry Congress will feature four days of technical meetings, round table luncheons, Division business meetings and special sessions. Running concurrently with the four-day sessions will be a program of Ladies' Entertainment and a series of visitations to foundries in the St. Louis area.

### Registration Fee Required

Entrance to Convention sessions will be by badge obtainable on registration. In accordance with the decision of the Board of Directors, a registration fee of $5.00 for members and $7.50 for non-members will be charged. Only sessions not requiring the badge and fee are the Gray Iron Shop Course and the Sand Shop Course.

A highlight of the 53rd Foundry Congress will be the Charles Edgar Hoyt Annual Lecture, to be delivered at the Annual Business Meeting by John Howe Hall, foundry consultant of Swarthmore, Pa., who will speak on *"Composite Structures Utilizing Steel Castings and Welding Methods."*

Climaxing the Convention will be the Annual Banquet, at which three A.F.S. Gold Medals and four Honorary Life Memberships in the American Foundrymen's Society will be awarded.

Sessions planned for the 53rd Annual Meeting of A.F.S. include five for aluminum and magnesium foundrymen, four each for brass and bronze, malleable and steel foundrymen; seven for gray iron; six for sand; three for education; and two for pattern. All sessions and meetings of general interest groups are shown in the tentative schedule in the January, 1949, issue of AMERICAN FOUNDRYMAN, page 25.

A feature of the 1949 Convention will be reports on A.F.S.-sponsored research projects being carried on in various phases of foundry operations. The first of these will be on the A.F.S. Sand Research Project at Cornell University and will deal with studies of the high temperature properties of molding sands.

### Schedule Reports on A.F.S. Research

A progress report on A.F.S. Steel Research will deal with the relationship between the properties of core sands and the development of hot tears.

The A.F.S. Malleable Iron Research Project report will outline efforts to develop the most desirable structure in pearlitic malleable iron, preparatory to selective hardening.

A report on investigations at the University of Michigan into ways of predicting melt quality in brass and bronze, will tell of work on a project to develop a suitable test bar with typical fracture characteristics which bear a definite relation to the quality of a typical tin bronze.

A motion picture film, taken at high speed, will

*One of the outstanding attractions of St. Louis is an excursion on Ol' Man River aboard the "Admiral", America's largest and finest inland passenger ship.*

make up part of the progress report on the Aluminum and Magnesium Research Project, being conducted at Battelle Memorial Institute to study the hydraulics of metal flow into a mold.

The A.F.S. Heat Transfer Committee will report on its study of heat flow as it relates to foundry problems, being conducted at Columbia University, and in several foundries.

Research into the feasibility of centrifugal casting of light alloys, being conducted at the Canadian Bureau of Mines under the sponsorship of the Aluminum and Magnesium Division's Centrifugal Casting Committee will be reported at the Convention.

### Convention to Feature Joint Meetings

Two joint meetings, an unusual feature of this year's convention, will be for gray iron and malleable and for gray iron and steel foundrymen. The gray iron-malleable session will be a symposium on nodular graphite cast iron. Metal flow in finger gates and step gates will be shown by motion picture and discussed at the gray iron-steel joint meeting.

Reviving a feature of earlier Conventions, there will be a Safety & Hygiene session, with addresses by Dr. Lloyd E. Hamlin, medical director, American Brake Shoe Co., and George Tubich, Michigan Department of Health.

*The Old Rock House, oldest building in St. Louis.*

### Gray Iron Round Table Luncheon Scheduled

For the first time, a Gray Iron Round Table Luncheon will be held at the 1949 A.F.S. Convention. Not scheduled in the past because the Gray Iron Shop Course adequately met needs for informal, discussion-type meetings, the luncheon has been arranged for this year's Convention in response to popular demand. As in the past, round table luncheons have been set for aluminum and magnesium, brass and bronze, malleable, pattern, and steel. A dinner for foundrymen and educators will be held again this year to provide an opportunity to exchange views on foundry education problems.

Continuing a practice of many years standing, the popular and heavily attended Gray Iron Shop Course and Sand Shop Course have been scheduled for 8:00 p.m. Monday, Tuesday, and Wednesday, the first three days of the Convention. Informal discussions in which many in the audience participate, the shop course sessions are scheduled for evenings to enable the greatest number of operating foundrymen to attend. These meetings are marked by free interchange of helpful hints and practical foundry-tested ideas.

*St. Louis Cathedral, one of the most magnificent in the world, erected at a cost of five million dollars.*

At the Annual Business Meeting, scheduled for 2:00 p.m., Wednesday, May 4, President W. B. Wallis will make the presidential address, officers and directors will be elected for the coming year, Apprentice Contest awards will be made, and the Charles Edgar Hoyt Annual Lecture will be presented.

Presentation of awards by President Wallis to the first place winners in the four divisions of the 1949 Annual A.F.S. Apprentice Contest climaxes this annual event, now in its 26th year, which opened October 15, 1948. Closing date is March 15.

Rounding out the four days of Convention activity is the Annual Banquet, last of a series of luncheon and dinner meetings which are A.F.S. Foundry Congress traditions. These meetings start with the Engineering School Graduates Luncheon on Monday, May 2, and include the Chapter Officers and Directors Dinner and the Canadian Dinner, both at 7:00 p.m., Tuesday, May 3. The A.F.S. Alumni Dinner, set for 7:00 p.m., Wednesday, May 4, again will bring together past and present officers and directors of the Society, and holders of A.F.S. Gold Medals and Honorary Life Memberships.

Special registration in the Canadian and the International Guest Books will take place at a booth near A.F.S. Convention Headquarters. Not required as is registration to participate in general Foundry Congress activities, the guest registration booth provides a convenient meeting place for international visitors. Examination of the book is often the means of locating a friend not known to be in attendance.

Plant visitations, long a feature of A.F.S. Conventions and another evidence of the cordiality and willingness to exchange information and ideas which marks A.F.S. members, are being arranged for the 53rd Annual A.F.S. Foundry Congress by the St. Louis District Chapter, host to the Convention.

# ANNOUNCE GOLD MEDALISTS
## And Honorary Life Membership Awards

SEVEN A.F.S. MEMBERS will be honored by the American Foundrymen's Society at the Annual Banquet, to be held during the 1949 Annual Convention at St. Louis, May 2-5. Three Gold Medals—the John H. Whiting Gold Medal, the Wm. H. McFadden Gold Medal, and the Peter L. Simpson Gold Medal—and four Honorary Life Memberships in the American Foundrymen's Society will be awarded in a formal presentation ceremony during the banquet.

S. C. Massari, technical director of the American Foundrymen's Society, will receive the John H. Whiting Gold Medal *"for outstanding contributions in the field of ferrous metallurgy, molding and foundry practice and service to the wartime foundry industry with the Chicago Ordnance District."* Presentation will be made by A.F.S. Past National President Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va.

***Gosta Vennerholm,*** *to receive the Wm. H. McFadden Gold Medal, is a native of Sweden and has studied metallurgy there and in Germany. Mr. Vennerholm joined Ford Motor Co., in 1920, and from 1933 to 1938 supervised reorganization of Ford foundries in Europe. He is today assistant head of chemical and metallurgical research at Rouge Plant.*

Gosta Vennerholm, Ford Motor Co., Dearborn, Mich., will be presented with the Wm. H. McFadden Gold Medal *"for outstanding contributions to the castings industry in the fields of both ferrous and non-ferrous metallurgy and practice."* Mr. Vennerholm's medal will be presented by A.F.S. Past National President F. J. Walls, International Nickel Co.

R. J. Anderson, Belle City Malleable Iron Co., Racine, Wis., will receive the Peter L. Simpson Gold Medal *"for outstanding service to the Society and in the public interest as chairman of the Wisconsin Chapter and of the Wisconsin Centennial Foundry Committee."* Presentation will be made by A.F.S. Past National President S. V. Wood, Minneapolis Electric Steel Castings Co., Minneapolis.

Recipients of Honorary Life Memberships in the American Foundrymen's Society this year will be:

***S. C. Massari*** *(John H. Whiting Gold Medal) is Technical Director of A.F.S. He was for 18 years research metallurgist, Association of Manufacturers of Chilled Car Wheels, and in World War II was awarded the Legion of Merit for his services as lieutenant colonel in charge of automotive tank production with the Army's Chicago Ordnance Dist.*

C. J. Freund, dean of the college of engineering, University of Detroit, *"for sincere and constant service on behalf of the castings industry by encouraging young men to enter the foundry trade."* Presentation of Dean Freund's Honorary Life Membership will be made by H. S. Falk, The Falk Corporation, Milwaukee.

Anthony J. Haswell, Dayton Malleable Iron Co., Dayton, Ohio, *"for outstanding and inspiring service to the industry as president of the Foundry Educational Foundation."* Presentation will be made by Ralph J. Teetor, Cadillac Malleable Iron Co., Cadillac, Mich.

Ralph L. Lee, Grede Foundries, Inc., Milwaukee, *"for steadfast and continuous service to the Society and the castings industry in the field of better foundry costs."* Mr. Lee's Honorary Life Membership will be presented by C. R. Culling, Carondelet Foundry Co.

***R. J. Anderson,*** *works manager of the Belle City Malleable Iron Co., Racine, Wis., will be awarded the Peter L. Simpson Gold Medal for outstanding Society and public service as Wisconsin Chapter chairman and as head of the Wisconsin Centennial Foundry Committee, which organized one of the outstanding industrial Exposition exhibits.*

A.F.S. National President W. B. Wallis, in keeping with A.F.S. tradition, will be awarded an Honorary Life Membership upon completion of his term as President of the American Foundrymen's Society.

### Awards Date Back to 1920

The history of A.F.S. Medal Awards dates back to 1920, when four of the five present awards were made possible through endowments presented by Joseph S. Seaman, A.F.S. President in 1900; John A. Penton, first secretary of the Society; John H. Whiting, president of the Whiting Corp.; and Wm. H. McFadden, A.F.S. President in 1907. The Peter L. Simpson Award was endowed in 1945 by A.F.S. Past National President Herbert S. Simpson in memory of his father, Peter L. Simpson, a distinguished foundryman and inventor of foundry equipment.

### Board of Awards Appointed

In keeping with the wishes of the donors that an "award, prize, medal or scholarship be conferred each year, if feasible, upon some person who shall, by his individual effort, have achieved very noteworthy results toward the attainment of those objects for which the Society was formed," a permanent Board of Awards was set up by the Board of Directors in 1922, to consist of the last seven living A.F.S. Past Presidents.

The deeds of gift for each award state that "the donor is interested in promoting the development of the arts and sciences practiced and applied by manufacturers in the production of metal castings."

Within the broad tenets of this proviso, the Board of Awards' selection of recipients is governed by the specific wishes of the donors:

### Specific Award Requirements

*Joseph S. Seaman Endowment*—"Mr. Seaman has long desired to do something to encourage young men in the foundry industry and to stimulate them in research in foundry problems." It was suggested by Mr. Seaman that the Award be made "for a paper presented, for some development of a process, or invention of a mechanical device."

*John A. Penton Endowment*—Mr. Penton suggested that the award be made for "the most noteworthy contribution along the line of electric furnace practice in the melting of ferrous and non-ferrous metals."

*John H. Whiting Endowment*—Mr. Whiting suggested that the award be made for "the most noteworthy contribution in the melting of metals in the cupola or air furnace."

*Wm. H. McFadden Endowment*—Mr. McFadden expressed his wish that his endowment fund be used "in a similar manner"to that of the other endowments.

*Peter L. Simpson Endowment*—The deed of gift states: "The award shall be conferred in recognition of any one of the following: (1) Annual Lecure—the primary object; (2) Preparation of material of a nature to promote public esteem of the foundry industry; and (3) Other achievement of a service of a nature reflecting credit upon the foundry industry."

The guiding principle of the Board of Awards, in searching for those men deserving of individual recognition by reason of their accomplishments in the field of cast metals, is to honor these men so as to encourage

***Anthony Haswell,*** *first president of the Foundry Educational Foundation, will receive an Honorary Life Membership in A.F.S. for his outstanding service in that capacity. A graduate of Princeton, he succeeded his father as president of the Dayton Malleable Iron Co. in 1942, and is a past president of the Malleable Founders' Society.*

***Ralph L. Lee,*** *secretary-treasurer, Grede Foundries, Inc., Milwaukee, will be awarded Honorary Life Membership in A.F.S. for outstanding work in the field of cost control as head of the A.F.S. Foundry Cost Committee. Mr. Lee presented the 1948 Exchange Paper of the A.F.S. to the Institute of British Foundrymen.*

## HONORARY LIFE MEMBERS

***W. B. Wallis,*** *A.F.S. National President, will receive Honorary Life Membership upon completion of his term, during which he will visit all chapters and most regional conferences. A graduate electrical engineer, he has been in the foundry industry since 1915 and is today president of Pittsburgh Lectromelt Furnace Corp.*

***Dean Clement J. Freund*** *of the University of Detroit's College of Engineering will receive an Honorary Life Membership for his work in encouraging young men to enter the foundry industry. Holder of an A.B. from Campion College and an M.E. from Marquette University, Dean Freund has long been prominent in engineering education.*

and inspire them to greater achievement within the fundamental objectives of the Society.

At the discretion of the Board of Awards, a nominee may be awarded an honor other than that for which nominated. Medal Awards may be made either to members or non-members of the Society, and to citizens of countries other than the United States.

The Board of Awards determines whether additional awards or honors shall be accepted and bestowed by the Society, and shall draft terms for all endowments, grants or deeds of gift awarded or bestowed for such purposes. Actions of the Board of Awards are subject to approval by the Board of Directors of the American Foundrymen's Society.

### How Nominations Are Made

Nominations for recipients of Gold Medal Awards of the Society may be made by members of past or present Boards of Awards, any elected A.F.S. officer, the Board of Directors of the Society, the Executive Committee of any of the Society's technical divisions or general interest committees, or by any member of the Society, excepting apprentice or student members. Nominations received from any other sources will be referred to an appropriate committee of the Society for consideration and report to the Board of Awards.

The practice of awarding Honorary Life Memberships in the American Foundrymen's Society began in 1924 as a means of rewarding faithful and continuous service to the Society, rather than the purely technical, scientific or metallurgical achievements honored by the A.F.S. Gold Medals. However, the awarding of a Gold Medal automatically qualifies the recipient for an Honorary Life Membership. Honorary Life Memberships are not confined to men of the castings industry, but may be awarded to outstanding men of other industries whose efforts are beneficial to the development of the castings industry.

Since the inception of the awards in 1924, it has been the custom of the American Foundrymen's Society to award the elected President of the Society an Honorary Life Membership on completion of term.

### Hoyt Lectureship An Honor

In addition to the A.F.S. Gold Medal Awards and Honorary Life Memberships, there is another activity related to the recognition of individual merit in the casting industry—selection of a speaker each year to deliver the Charles Edgar Hoyt Annual Lecture, one of the highlights of the Annual A.F.S. Convention. Speakers so honored are chosen by the Annual Lecture Committee as being outstanding in some particular phase of the foundry industry or in general industry. Instigated in 1938 as the Awards Lecture, the name was changed in 1943 to Foundation Lecture, and in 1947 to the Charles Edgar Hoyt Annual Lecture.

The lecturer so chosen receives no award, but customarily receives an emolument or suitable recognition and appropriate scroll from the Society as an expression of its appreciation. This year's Hoyt Lecturer is one of the first two men to receive an A.F.S Gold Medal—John Howe Hall, foundry consultant of Swarthmore, Pa., who was awarded the John H. Whiting Gold Medal in 1924 for his contributions to the steel casting industry.

## Deadline Approaching For Entries In 1949 A.F.S. Apprentice Contest

LAST CALL FOR ENTRIES in the 1949 A.F.S. Apprentice Contest is announced by the Contest Committee. All North American foundries and pattern shops, regardless of whether or not they are affiliated with the American Foundrymen's Society, are eligible to enter qualified, indentured apprentices before March 15.

Blueprints for the pattern division of the contest and patterns for the molding divisions are furnished by A.F.S. This year, for the first time, patterns for the same castings will be used for all three molding divisions. Castings are expected to illustrate the types of gating and risering used for the various alloys.

This year American Steel Foundries, Inc., Granite City, Ill., and Scullin Steel Co., St. Louis, have offered to radiograph the castings entries for internal soundness—each to radiograph 50 per cent of the entries. The practice of having firms in the area of the A.F.S. Convention City, where the Apprentice Contest is judged, radiograph the entries began two years ago when Ford Motor Co., Dearborn, Mich., volunteered the use of its equipment prior to the Detroit Convention. Last year Dodge Steel Co., Philadelphia, radiographed the castings entries for the Contest.

### Molding and Patternmaking Competitions

Competition is open in steel molding, gray iron molding, non-ferrous molding (including aluminum and magnesium molding as well as molding copper-base and other non-ferrous alloys), and patternmaking. Prizes of $100, $50, $25 will be awarded the three top winners in each division. All winners receive a certificate of recognition, and the four first prize winners will receive round trip rail and Pullman fare to the A.F.S. Annual Convention, to be held in St. Louis.

The contest is open to any apprentice taking a training course of not less than three years' duration, who is not over 24 years of age on the day he competes in the contest. Veterans of World War II are eligible if their age less their term of service is not over 24.

United States entrants are requested to apply, through their sponsors, to the American Foundrymen's Society, 222 West Adams St., Chicago, 6, Ill. For the first time, this year Canadian entrants are requested to apply directly to G. Ewing Tait. Dominion Engineering Works, Ltd., Box 220, Montreal.

Several A.F.S. chapters, as in the past, will this year conduct local contests to select patterns and castings to be sent to St. Louis for final judging. Sponsors and entrants are urged to consult officials of the nearest A.F.S. chapter to see whether a local contest will be held, before entering directly in the national contest. Plants in areas where a chapter contest will not be held may conduct a plant contest to select entrants for the finals.

Last day for entering the 1949 A.F.S. Apprentice Contest is March 15. Judging will take place in St. Louis early in April. All castings and patterns entered in the finals will be exhibited during the 1949 A.F.S. Convention in St. Louis, May 2-5. Prize winning castings and patterns will go on exhibit at the Museum of Science and Industry, Chicago, for a year.

# INSTALL TWO STUDENT CHAPTERS

## *Induct Texas A&M, Oregon State December 7*

SIMULTANEOUS CEREMONIES, held over a thousand miles apart on the night of December 7, marked the installations of the first A.F.S. student chapter on the West Coast—Oregon State College—and the first in the South—at Texas A & M College.

"The Foundry Is a *Good* Place to Work" was the theme of the installation ceremonies at Oregon State College, Corvallis, Ore., where the sixth A.F.S. student chapter was officially welcomed into the American Foundrymen's Society. The evening's activities began with a dinner, prepared and served in the school's foundry, and utilizing a good deal of foundry equipment for heating and serving the food. Castings made by student members were used as serving bowls, sugar bowls and relish dishes.

### College President Addresses Group

The meeting was opened by Student Chapter Chairman J. R. Oettinger, who presided. Dr. A. L. Strand, president of Oregon State College, welcomed visiting A.F.S. officials and members of the Oregon chapter and pledged the cooperation of the college in making the student chapter a success.

Following Dr. Strand's address, Oregon Chapter Chairman J. Otis Grant, Electric Steel Foundry Co., Portland, presented the student chapter with a gavel and block on behalf of the Oregon chapter. The gavel and block are replicas of a bench rammer and molding flask. Following this, George Cox, head of the College's Engineering and Industrial Arts department, briefly outlined the history of OSC's Foundry department.

Guest-of-honor W. B. Wallis, A.F.S. National President, delivered an inspirational message on the opportunities that exist for the young college graduate in the foundry industry and explained how the American Foundrymen's Society is helping the engineering graduate through its Educational division, the student chapter program, and the dissemination of the latest technical information through its publications and technical meetings.

Dean George W. Gleason of the Oregon State College engineering school, principal speaker of the evening, chose as his subject, *"Power."* Dean Gleason stated that the greatest potential source of power for mankind's projects is the sun. Continued research into ways of harnessing the sun's rays, he said, will someday result in the conservation of the earth's natural resources, especially the dwindling quantities of coking coals used today in the manufacture of metallurgical coke. Dean Gleason concluded his address by discussing the advantages and limitations of various sources of power, and advocated the establishment of research activities that will not only benefit this generation, but will be today's gift to future generations.

Some 20 Portland foundry owners, managers and operators, members of the A.F.S. Oregon chapter, attended the dinner and ceremonies, and were conducted on a tour of the college's foundry facilities by student chapter members, preceding the meeting.

### Install Texas A&M Chapter

The seventh student chapter of the American Foundrymen's Society was officially installed with the famous cast iron rattle on the same evening as the ceremony at Oregon State College. A.F.S. Secretary-Treasurer Wm. W. Maloney made the installation of the Texas A & M College student chapter on behalf of the Board of Directors by presenting the rattle to John A. Whitacre, Jr., chairman of the student group.

Some 25 members of the A.F.S. Texas chapter attended the installation ceremony, held in College Station, Tex., coming from points more than 200 miles distant to show their interest in education for the

*Student chapter officers, faculty members and foundrymen from the Texas chapter photographed with A.F.S. National Secretary-Treasurer Wm. W. Maloney, who officially installed the South's first A.F.S. student chapter at Texas A & M College December 7. Left to right: Lloyd G. Berryman, faculty advisor; Secretary V. C. Henkel; Treasurer C. C. Spraggins; Vice-President B. D. Stone; Mr. Maloney; Jake Dee, chairman, Texas Chapter; M. J. Henley, student chapter industrial advisor and J. A. Whitacre, chapter president.*

*J. A. Whitacre, left, chairman of the newly-formed Texas A & M College student chapter, receives the cast iron rattle signifying the chapter's acceptance into the American Foundrymen's Society from A.F.S. National Secretary-Treasurer Wm. W. Maloney.*

foundry industry. Heading the delegation of Texas foundrymen were Jake Dee, Dee Brass Foundry, Houston, chairman of the Texas chapter, Past National Director F. M. Wittlinger, Texas Electric Steel Castings Co., Houston, and J. O. Klein, Texas Foundries, Inc., Lufkin, who was one of the principal speakers at the ceremony.

Installation Day began with a tour of the campus and foundry facilities of the college, conducted by Professor Crawford, head of the mechanical engineering department, and Associate Professor Lloyd Berryman, in charge of foundry work at Texas A & M and faculty advisor to the student chapter. Accompanying the party was Malcolm Henley, Texas Foundries, Inc., Lufkin, industrial advisor to the student group.

### Plan Texas College Scholarships

Dinner was served at a College Station restaurant and some 30 members of the faculty and student group attended, including Dean Barlow of the college of engineering. As the principal speaker, J. O. Klein announced that a plan is now under way among Texas foundries to set up scholarships in Texas colleges and universities and added that the foundries of the state are expressing more and more desire for engineering school graduates, in realization of the importance of adapting engineering principles to castings.

Secretary-Treasurer Maloney described the organization of the American Foundrymen's Society, and told of the opportunities that membership in the student chapter affords. He urged members of the new group to play an active part in its activities and to keep in mind the opportunities that the foundry industry affords the engineering college graduate.

Concluding the installation ceremonies, Malcolm Henley, industrial advisor to the student chapter, announced that interest has been displayed in forming a second Texas student chapter at the University of Texas, Austin, sometime in the near future.

## To Feature Gray Iron, Sand Shop Courses at 1949 A.F.S. Convention

GRAY IRON AND SAND SHOP COURSES will be held in three sessions each, during evenings following the regular daily technical sessions of the 53rd Annual A.F.S. Convention, to be held in St. Louis, May 2-5. Always an extremely popular feature of the Convention, these informal discussion sessions are held evenings to enable local foundrymen to attend.

Badges, obtainable only upon registration and payment of registration fees (members, $5.00; non-members, $7.50) and required for all other Convention sessions and events, are *not* required for those attending the shop courses only.

At one Gray Iron Shop Course session a six-man panel will discuss *"Metal Losses in the Foundry."* Other sessions will cover *"Inexpensive Tests for the Small Gray Iron Foundry"* and *"Carbon Trends in Gray Iron."*

Sessions planned for the Sand Shop Courses are steel, *"Penetration;"* gray iron and malleable iron, *"Resin Bonded vs. Oil Bonded Core Sands;"* and nonferrous, *"Core Blowing."*

## Select 1950 Annual Hoyt Lecturer

THE 1950 CHARLES HOYT ANNUAL LECTURER will be W. W. Levi, chief metallurgist, Lynchburg Foundry Co., Lynchburg, Va., it is announced by Gosta Vennerholm, Ford Motor Co., Dearborn, Mich., chairman of the A.F.S. Annual Lecture Committee, which met December 3 at A.F.S. Headquarters.

Members of the Committee voted unanimously to invite Mr. Levi as the 1950 Hoyt Lecturer and specified that the Lecture be on the subject of cupola operation in gray iron founding—a topic believed by the Committee to be of intense interest to a great number of foundrymen.

The A.F.S. Annual Lecture Committee, headed by Mr. Vennerholm, is comprised of Past National President Fred J. Walls, International Nickel Co., Detroit,

***W. W. Levi,*** *unanimously chosen by the A.F.S. Annual Lecture Committee to give the 1950 Charles Edgar Hoyt Annual Lecture, received a B.S. in Chemical Engineering from the University of Michigan and later did post graduate work in France. A member of several A.F.S. Gray Iron Division Committees, he is well-known as an A.F.S. speaker.*

A.F.S. Past National President H. Bornstein, Deere & Co., Moline, Ill.; H. M. St. John, Crane Co., Chicago; R. E. Ward, Eclipse-Pioneer Division, Bendix Aviation Corp., Teterboro, N. J.; and Carl F. Joseph, Central Foundry Division, General Motors Corp., Saginaw, Mich.

# ANNOUNCE PROGRAM FOR OHIO REGIONAL MEETING

SPONSORED BY THE FIVE OHIO CHAPTERS of the American Foundrymen's Society and by Ohio State University, in conjunction with the University's 75th Anniversary Celebration, the Second Ohio Regional Foundry Conference will feature as its theme "New Developments for the Operating Foundryman." The conference will be held March 11 and 12 on the Ohio State campus, under the aegis of the Central Ohio, Canton District, Northeastern Ohio, Cincinnati District and Toledo chapters of A.F.S.

Dr. Douglas C. Williams of Ohio State University's industrial engineering department is general conference chairman. Conference directors, chairmen of the five A.F.S. Ohio chapters, are: Fred W. Fuller, National Engineering Co., representing the Central Ohio chapter; Walter E. Sicha, Aluminum Company of America, representing the Northeastern Ohio chapter; Edward H. Taylor, F. E. Myers & Bros. Co., representing the Canton District chapter; J. D. Judge, Hamilton Foundry & Machine Co., representing the Cincinnati District chapter; and Emmet E. Thompson, Unitcast Corp., representing the Toledo chapter.

Following opening ceremonies in University Hall on the morning of March 11 and a luncheon in the University cafeteria, the afternoon session will be devoted to gray iron, steel, malleable iron and nonferrous technical meetings.

In the evening, the annual conference dinner will have as its speaker Dr. Eleroy L. Stromberg of the department of psychology of Western Reserve university, who will address the group on a *"New Approach to Selection of Foundry Personnel."*

Saturday morning's program, as on the previous day, will be devoted to gray iron, steel, malleable iron and non-ferrous sectional meetings, divided into two sessions each, one at 9:30 a.m. and the other at 11:00 a.m., all at the Deshler-Wallick hotel.

Climaxing the conference will be the annual luncheon, at which a program will be provided by the Foundry Educational Foundation, under the chairmanship of George K. Dreher, FEF executive director. Dan E. Krause, general manager of the Gray Iron Research Institute, will be luncheon toastmaster.

## CONFERENCE PROGRAM

### Friday, March 11

9:00 a.m.—REGISTRATION, University Hall, Ohio State University.

10:30 a.m.—OPENING SESSION. University Hall. Opening address, Dean C. E. MacQuigg, College of Engineering, Ohio State University. Welcome by Chapter Chairman Fred W. Fuller of the Central Ohio chapter, host to the Ohio Regional Foundry Conference.

*"The Design of Crankshafts and Center Frames for Diesel Engines,"* T. C. Kuivinen, Cooper-Bessemer Corp., Mt. Vernon, Ohio.

*"Sound Castings CAN Be Engineered"*, W. T. Bean, Jr., Continental Aviation and Engineering Corp., Detroit.

1:00 p.m.—LUNCHEON. Address by Dr. Howard A. Bevis, president of Ohio State University.

*"The Foundry Curriculum at Ohio State,"* Dr. Paul N. Lehoczky, Department of Industrial Engineering, Ohio State University.

2:30 p.m.—SECTIONAL MEETINGS.

Gray Iron—*"Something New in Foundry Sand,"* Harry W. Dietert, Harry W. Dietert Co., Detroit.

Steel—*"Good Housekeeping Pays Off,"* Robert G. Scott, Commercial Steel Castings Co., Marion, Ohio.

Malleable Iron—*"Production Patterns for Malleable Foundries,"* Vincent J. Sedlon, Master Pattern Co., Cleveland.

Non-Ferrous—*"Nickel and Nickel Silver Alloys,"* L. E. Grubb, International Nickel Co., Bayonne, N. J.

4:00 p.m.—SECTIONAL MEETINGS.

Gray Iron—*"Recent Developments in Cupola Operation,"* L. L. Clark, Buick Motor Car Co., Flint, Mich.

Steel—*"Metal Penetration,"* A. J. Kiesler, General Electric Co.

Malleable Iron—*"Metallurgical Headaches of Scrap Iron in the Malleable Industry."* Milton Tilley, National Malleable & Steel Castings Co., Cleveland.

Non-Ferrous—*"Another Approach to New Developments in Making Non-Ferrous Castings,"* William Ball, R. Lavin & Sons, Inc., Chicago.

7:00 p.m.—DINNER. Deshler-Wallick Hotel, Columbus. *"New Approach to Selection of Foundry Personnel,"* Dr. Eleroy L. Stromberg, Department of Psychology, Western Reserve University.

### Saturday, March 12

9:00 a.m.—REGISTRATION. Deshler-Wallick Hotel.

9:30 a.m.—SECTIONAL MEETINGS.

Gray Iron—*"Methods of Production and Properties of Nodular Gray Iron,"* C. O. Burgess, Gray Iron Founders Society.

Steel—*"Oxygen Injection Treatment of Steel Melts,"* J. B. Davenport, Air Reduction Co., Detroit.

Malleable Iron—*"Gating and Risering of Malleable Castings,"* Harold Sieggreen, Central Foundry Division, GMC.

Non-Ferrous—*"New Developments in Determining the Fluidity of Aluminum Castings,"* Walter E. Sicha, Aluminum Co. of America.

11:00 a.m.—SECTIONAL MEETINGS. Deshler-Wallick Hotel.

Gray Iron—*"The Modern Gray Iron Foundry,"* E. E. Ballard, Lester B. Knight & Associates, Chicago.

Steel—*"X-Ray and Its Practical Application for the Steel Foundryman,"* R. M. Landis, General Electric X-Ray Corp.

Malleable Iron—*"Finishing Control,"* John Zeindler, Albion Malleable Iron Co., Albion, Mich.

Non-Ferrous—*"New Developments in Non-Ferrous Melting Equipment and Practice,"* Round Table Discussion.

1:00 p.m.—LUNCHEON. Program to be presented by the Foundry Educational Foundation. George K. Dreher, chairman.

General chairman for the conference, Dr. Douglas C. Williams, Ohio State University, is assisted by the following committee chairmen and members:

*Program*—Chairman, D. E. Krause, Gray Iron Research Institute; vice-chairman, N. J. Dunbeck, Eastern Clay Products Co.; Fred J. Pharr, Lake City Malleable Iron Co.; J. S. Schumacher, Hill & Griffith Co.; Harry J. Schwab, Bunting Brass & Bronze Co.; Charles F. Bunting, Pitcairn Corp.; George K. Dreher, Foundry Educational Foundation.

*Registration*—Chairman, Kenneth McGrath, Altens Foundry & Machine Co. Assisted by members of the Ohio State University student chapter.

*Publicity*—Chairman, J. G. Lummis, A. P. Green Firebrick Co.; C. P. Greenidge, Battelle Memorial Institute; Karol Whitlach, Aetna Firebrick Co.; Wilfred H. White, Jackson Iron & Steel Co.

*Housing*—Chairman, Walter Deutsch, Columbus Malleable Iron Co.; E. M. Durstine, Keener Sand & Clay Co.

*Finances*—Chairman, William T. Bland, Commercial Steel Castings Co.; J. J. Witenhafer, Columbus Malleable Iron Co.; Robert Willey, Commercial Steel Castings Co.

*Student Participation*—Ohio State University student chapter of American Foundrymen's Society.

# Producing NODULAR GRAPHITE with MAGNESIUM

**C. K. Donoho**
**Chief Metallurgist**
**American Cast Iron Pipe Co.**
**Birmingham, Ala.**

THE ORIGINAL RESEARCH WORK leading to the production of nodular graphite cast irons was sponsored by the British Cast Iron Research Association and was publicly announced by presentations and publications of H. Morrogh et al.[1,2] both in England and in America in March and April, 1948. Morrogh revealed that by controlled treatment with cerium a hypereutectic, low sulphur, low phosphorus cast iron can be made to freeze with the graphite in a nearly spherical form instead of in the familiar flake form. This structural change brings about a substantial improvement in strength, ductility and toughness of the iron. We are greatly indebted to the BCIRA for this development which stands as an epoch-making contribution to cast iron metallurgy.

At the American Cast Iron Pipe Co., where control of graphite form in cast iron had been studied for many years, this new development was naturally of the greatest interest. The British results on the effect of cerium were immediately confirmed, and subsequently tests with magnesium additions were carried on. From more than 150 experimental heats, with several casts from each heat, information has been accumulated indicating considerable promise for magnesium treated cast iron as an engineering material.

Pure magnesium metal, with a boiling point of 2030 F, is gaseous at molten iron temperatures and burns explosively in air. Any foundry planning experiments with magnesium additions to cast iron should keep in mind that magnesium in any form may be violently explosive. First trials should be made to small quantities of iron and with suitable protection for personnel and adjacent flammable structures.

Nodular graphite cast iron can be produced by adding pure stick magnesium on the surface of iron in the ladle. In spite of a loss of probably 95 per cent of the magnesium, with an addition of around one per cent sufficient magnesium may be retained in the metal to produce the desired effect (Figs. 1 and 2).

A search of various alloys of magnesium was undertaken in the attempt to develop an alloy which would give higher and more consistent recovery of magnesium and less violent reaction during addition. Table 1 shows typical results obtained with several alloys added to the high carbon, low phosphorus, low sulphur type of iron favored for the cerium treatment. The eight heats shown were melted in an acid-lined ex-

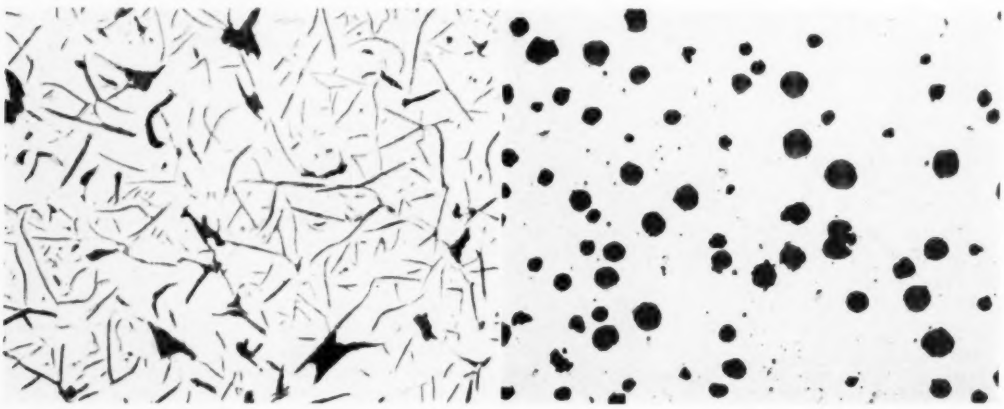


*Fig. 1—Photomicrographs showing effect of magnesium on graphite form. Left—plain iron. Right—treated in the ladle with one per cent pure stick magnesium. X100.*

**This paper will be presented at the Birmingham Regional Foundry Conference, Feb. 17-19, 1949, sponsored by the A.F.S. Birmingham District Chapter. A preliminary report of the investigation was made at the A.F.S. Michigan Regional Foundry Conference, at Michigan State College, Oct. 1-2, 1948.**

perimental induction furnace and the magnesium additions made to the separate ladles poured from each melt. To each ladle, after the magnesium alloy addition, 0.40 per cent Si as 75 per cent ferrosilicon was added and stirred in.

Duplicate one-inch diameter test bars about 5 in. long were cast in dry sand molds from each ladle, and pins for spectrographic analysis were obtained for most of the heats. Cast iron type tensile bars, 0.505 in. in diameter, were machined and tested from at least one bar for each ladle, and Brinell hardnesses were determined on broken tensile bars by grinding a flat on the threaded end. Micro-examinations were made on sections from the broken tensile bars.

Results obtained with a 50 per cent nickel-magnesium alloy are shown in Heat I-329. Increasing additions of magnesium were made to successive ladles until with 0.63 per cent magnesium added a fully nodular graphite structure was obtained. Analysis for magnesium in the iron is made by spectrograph using chemically analyzed standards for comparison. In this heat 0.045 per cent Mg is required to completely nodularize the graphite. Recoveries of magnesium with this alloy averaged under 10 per cent.

Heat I-330 shows results with three different magnesium alloys. An addition of 0.50 per cent Mg as the Ni-Mg alloy produced nodular graphite in this iron, but both the Mg-Zr and the Mg-Ti alloys gave entirely flake graphite irons of normal strengths. Several other trial casts with zirconium and titanium alloys added in varying amounts always gave the flake form of graphite with no nodules. Other alloys with which no useful results could be obtained are Ca-Mg and Mn-Mg, although the latter was not tested extensively. Apparently there are some elements which, added with magnesium, render inoperative some nucleating mechanism which initiates the formation of nodular graphite.

Heat I-340 shows that magnesium airplane scrap (containing 9 per cent Al and 2 per cent Zn) is effec-

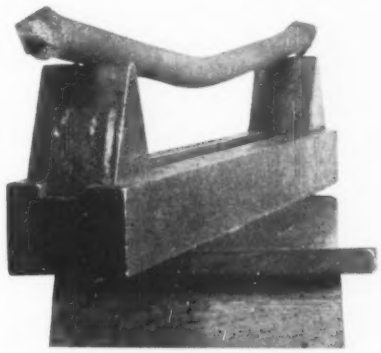


*Fig. 2—Transverse test on 1.2-in. bar cast from nodular iron shown in photomicrograph of Fig. 1. Load—5,200 lb.; deflection—1.75-in. on 18-in. span.*

TABLE I—EFFECT OF ADDING MAGNESIUM ALLOYS TO HIGH CARBON—LOW PHOSPHORUS IRONS

| Heat No. | TC | Si* | S | Mn | P | Form of Magnesium | Magnesium, per cent | | | Tensile Strength | Bhn |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Added | Anal. | Recov. | 1000 psi | |
| | | | | | | Ni-Mg 50-50 Alloy | 0.25 | 0.025 | 10 | 12.5 | 111 |
| I-329-1 | 4.05 | 2.33 | 0.037 | 0.59 | 0.07 | Ni-Mg 50-50 Alloy | 0.38 | 0.028 | 8 | 19.7 | 103 |
| -2 | 4.18 | 2.21 | 0.043 | 0.58 | ... | Ni-Mg 50-50 Alloy | 0.50 | 0.029 | 6 | 28.0 | 90 |
| -3 | 4.13 | 2.61 | 0.040 | 0.60 | ... | Ni-Mg 50-50 Alloy | 0.63 | 0.045 | 7 | 95.1 | 223 |
| -4 | 4.06 | 2.39 | 0.040 | 0.57 | ... | | | | | | |
| I-330-1 | 3.94 | 3.00 | 0.064 | 1.05 | 0.11 | Zr-Mg 40-60 Alloy | 0.50 | .... | .. | 20.0 | 121 |
| -2 | 3.90 | 2.91 | 0.046 | 1.19 | ... | Ni-Mg 50-50 Alloy | 0.50 | .... | .. | 90.6 | 235 |
| -3 | 3.93 | 2.56 | 0.048 | 1.00 | ... | Ti-Mg 50-50 Alloy | 0.50 | .... | .. | 18.3 | 107 |
| I-340-1 | 4.18 | 1.58 | 0.044 | 0.71 | 0.16 | | None | .... | .. | 20.1 | 126 |
| -2 | 4.16 | 1.78 | 0.043 | 0.71 | ... | Mg Scrap | 0.60 | .... | .. | 50.9 | 174 |
| -3 | 4.14 | 2.02 | 0.047 | 0.78 | ... | Mg Scrap | 0.75 | .... | .. | 104.3 | 229 |
| -4 | 3.96 | 1.68 | 0.047 | 0.69 | ... | Al Scrap | None | .... | .. | 22.5 | 143 |
| I-370-1 | 3.57 | 2.20 | 0.027 | 0.64 | 0.06 | Cu-Mg 50-50 Alloy | 0.60 | 0.053 | 9 | 113.0 | 255 |
| -2 | ... | ... | .... | ... | ... | Mg-Li 90-10 Alloy | 0.75 | 0.048 | 6 | 86.6 | 255 |
| 3 | ... | ... | .... | ... | ... | Mg-Si 80-20 Alloy | 0.60 | 0.060 | 10 | 98.2 | 223 |
| I-410-1 | 3.62 | 2.61 | 0.048 | 0.55 | 0.037 | Cu-Mg 70-30 Alloy | 0.26 | 0.029 | 11 | 42.2 | 192 |
| -2 | ... | ... | .... | ... | ... | Cu-Mg 70-30 Alloy | 0.40 | 0.068 | 17 | 117.8 | 285 |
| -3 | ... | ... | .... | ... | ... | Cu-Mg 70-30 Alloy | 0.55 | 0.056 | 10 | 114.5 | 255 |
| I-374-1 | 3.71 | 1.87 | 0.030 | 0.60 | 0.08 | Cu-Mg 80-20 Alloy | 0.20 | 0.024 | 12 | 22.7 | 103 |
| -2 | ... | ... | .... | ... | ... | Cu-Mg 80-20 Alloy | 0.30 | 0.035 | 12 | 119.0 | 255 |
| -3 | ... | ... | .... | ... | ... | Cu-Mg 80-20 Alloy | 0.40 | 0.065 | 16 | 104.7 | 293 |
| I-404-1 | 3.44 | 2.19 | 0.040 | 0.62 | 0.03 | Ni-Mg 82-18 Alloy | 0.22 | 0.058 | 26 | 124.1 | 285 |
| -2 | ... | ... | .... | ... | ... | Ni-Mg 82-18 Alloy | 0.30 | 0.085 | 28 | 116.0 | 277 |
| -3 | ... | ... | .... | ... | ... | Ni-Mg 82-18 Alloy | 0.42 | 0.094 | 22 | 106.0 | 285 |
| I-402-1 | 3.70 | 1.82 | 0.045 | 0.60 | 0.07 | Cu-Mg 80-20 Alloy | 0.22 | 0.044 | 20 | 118.0 | 285 |
| -2 | ... | ... | .... | ... | ... | Ni-Mg 82-18 Alloy | 0.28 | 0.084 | 30 | 96.8 | 285 |
| -3 | ... | ... | .... | ... | ... | Cu-Mg 80-20 Alloy | 0.36 | 0.058 | 16 | 116.8 | 285 |
| -4 | ... | ... | .... | ... | ... | Ni-Mg 82-18 Alloy | 0.40 | 0.118 | 30 | 100.2 | 285 |

*0.40 per cent Si added to each ladle as 75 per cent ferrosilicon just before casting

TABLE 2—EFFECT OF LOWER CARBON CONTENT

| Heat No. | TC | Si | S | Mn | P | Crucible Additions, per cent | Magnesium, per cent Added* | Anal. | Recov. | Tensile Strength, 1000 psi | Bhn |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1-344-1 | 3.85 | 2.70 | 0.016 | 0.65 | 0.10 | | 0.75 | 0.048 | 6½ | 92.0 | 212 |
| -2 | 3.72 | 2.66 | 0.020 | 0.71 | ... | 10 Steel—0.25 Si | 0.75 | 0.045 | 6 | 90.5 | 217 |
| -3 | 3.48 | 2.69 | 0.023 | 0.69 | ... | 10 Steel—0.25 Si | 0.75 | 0.060 | 8 | 85.4 | 223 |
| -4 | 3.15 | 2.93 | 0.022 | 0.76 | ... | 10 Steel—0.25 Si | 0.75 | 0.049 | 6½ | 98.7 | 229 |

*Magnesium added to each ladle as magnesium airplane scrap containing some aluminum and zinc. In each case the magnesium addition was followed by a ladle addition of 0.40 per cent Si as 75 per cent ferrosilicon.

tive in producing nodular iron when added in sufficient amount. Ladle 4 of this heat was intended to be a higher addition of magnesium, but the addition was later found to be an alloy of aluminum instead of magnesium, which did not produce useful results. Figure 3 shows the plain and etched structures of the iron from Ladle 3 of this heat.

Heat 1-370 shows the effectiveness of a 50 per cent Cu-Mg alloy in producing a high strength nodular graphite iron.

Alloys of magnesium with lithium and silicon were somewhat effective but showed no particular advantage in these tests.

In Heat 1-410 a 70 per cent Cu-Mg alloy is shown to give a very high strength nodular iron with an addition of only 0.40 per cent Mg, and magnesium recovery was 10 to 17 per cent.

With 80 per cent copper alloy a 0.30 per cent Mg addition was sufficient (Heat 1-374) and recovery of magnesium was more consistent. An alloy with 82 per cent Ni gave magnesium recovery of over 20 per cent and excellent properties with only 0.22 per cent Mg added (Heat 1-404). With this addition the irons contain about one per cent Ni which adds somewhat to the strength.

Heat 1-402 compares the effect of the 80 per cent Cu and the 82 per cent Ni alloy. The copper alloy gave higher strengths, but the nickel alloy gave better magnesium recovery. This indicates that magnesium content can be too high for best properties, and that about 0.05 per cent contained magnesium is normally about optimum. Other magnesium alloys which have been proved to be at least somewhat effective include Al-Mg, Fe-Mg and Bi-Mg.

In most cases the results of alloying to decrease the reactivity of the magnesium were somewhat disappointing. The 50 per cent alloys of nickel and copper are substantially as explosive when added to molten iron as is pure magnesium, although the increased density of the alloys contributes to more consistent recoveries. Neither the iron, silicon nor aluminum alloys with 50 per cent or more of magnesium showed any significant lessening of the reactivity.

Only when the magnesium was greatly diluted, as in the alloys of nickel and copper with about 20 per cent magnesium, did the violence of the reaction substantially decrease. With about 20 per cent magnesium the nickel alloy is more violent than the copper alloy, presumably because the magnesium volatilizes and explodes the still solid nickel, while in the copper alloy the copper melts before the magnesium volatilizes. However, the magnesium recovery was somewhat better with the nickel alloy, as is shown in Table 1.

### Methods of Adding Magnesium

One practical method of treating iron in the ladle with magnesium is to use an alloy in which the magnesium is diluted to the extent that the reaction during solution is not explosive. The 80 per cent Cu-Mg alloy is not explosive, but burns rather quietly on the surface of the metal, and is perfectly usable even within a crowded foundry. The 70 per cent Cu alloy is distinctly more violent but can be used safely if some simple precautions are taken. It is said that with alloys of 90 per cent or higher of nickel or copper with mag-

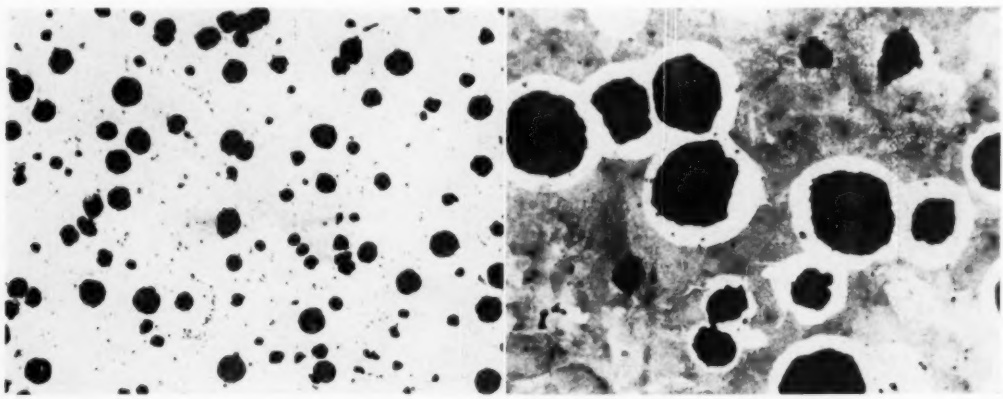


*Fig. 3—Cast iron structures from Heat 1-340-3 (Table 1). Left—unetched. X100. Right—Etched. X300.*

nesium the metal is quiet and recoveries consistent.

While the use of low magnesium content alloys appears to offer a safe method of adding magnesium to iron, it is hard to justify buying so much copper and/or nickel simply to dilute the magnesium. In some cases, of course, other alloys such as copper or nickel are required in addition to the magnesium, but we have shown that only magnesium is necessary to the production of high grade nodular irons.

Another approach is to accept the hazards of adding pure magnesium and install protective equipment accordingly. It should be readily feasible to install a hood-protected station for magnesium addition in the foundry. Ladles for magnesium treatment could be run under the hood, magnesium metal or scrap added through a suitable chute, and the burning vapors exhausted to the atmosphere through a stack. After the reaction subsided the ladle would be moved to the pouring floor.

Possibly more efficient methods will be worked out to protect the magnesium from burning while bringing it into contact with the iron gradually so that a reasonably complete recovery can be obtained.

In addition to the cost of cerium, the drawback to the cerium process is that a high carbon (hypereutectic), low sulphur and low phosphorus, base iron is required. The magnesium treatment appears to be effective in a much wider range of iron compositions. Table 2 shows results of an experimental heat to determine the effect of carbon content. To a high-carbon melt successive additions of steel scrap and ferrosilicon were made to lower the carbon in steps while maintaining the rest of the composition fairly constant. Even when the carbon was lowered to 3.15 per cent a ladle addition of 0.75 per cent Mg followed by 0.40 per cent Si produced a true nodular iron. In subsequent tests nodular graphite was produced in irons as low as 2.50 per cent in total carbon.

Sulphur content of the iron affects both the cerium and magnesium treatments as both are desulphurizers and the nodularizing effect occurs only after sulphur has been brought down to a fairly low level. With magnesium treatment no particular difficulty was experienced in producing nodular irons from direct cupola metal containing about 0.09 per cent S as melted. Some excess magnesium must be added, and the residual sulphur after treatment is usually found to be in the range of 0.03 to 0.04 per cent. With the magnesium treatment it may be found less expensive to add extra magnesium for desulphurizing than to desulphurize with alkalis before adding magnesium.

In most of the tests manganese has been in the range of 0.50 to 0.80 per cent. There is some indication that with higher manganese contents less magnesium is required. In Table I, compare 1-329-3 with 1-330-2.

Phosphorus is said to reduce the solubility of cerium in iron so that nodular graphite cannot be produced by cerium in cast irons with phosphorus content over about 0.50 per cent. This limitation does not apply to the magnesium treatment as nodular graphite has been readily obtained in irons with phosphorus up to 0.70 per cent. However, phosphorus must at present be considered a harmful element as the tests to date indicate that phosphorus over about 0.15 per cent progressively increases shrinkage and lowers ductility. An idealized diagram of the effect of phosphorus content on 1.2 in. diameter transverse bar tests is shown in Fig. 6.

In the amounts required to produce nodular graphite magnesium acts as a carbide stabilizer. For this reason a final silicon content of over 2 per cent is preferred. Late addition of part of the silicon (inoculation) assists in breaking down carbides and prevention of mottling. In Table 3, Heat I-347 shows comparison of Ni-Mg and magnesium scrap with and without the late silicon addition. It was thought that the aluminum present in the magnesium scrap might act as an inoculant. However, when the late silicon was omitted both alloys gave mottled structures in the iron used, which had a relatively low carbon content.

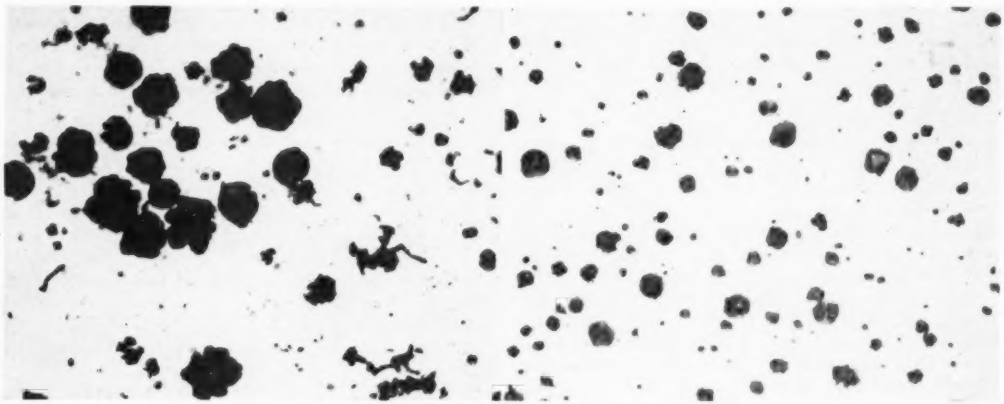


*Fig. 4—Photomicrographs showing effects of simultaneous and separate additions of Mg and Si. Left— Mg alloy and FeSi added together; 1.20-in. bar load, 6,130 lb; deflection, 0.56-in. Right— Mg alloy added first, then FeSi; bar load, 6,640 lb.; deflection, 0.82-in.*

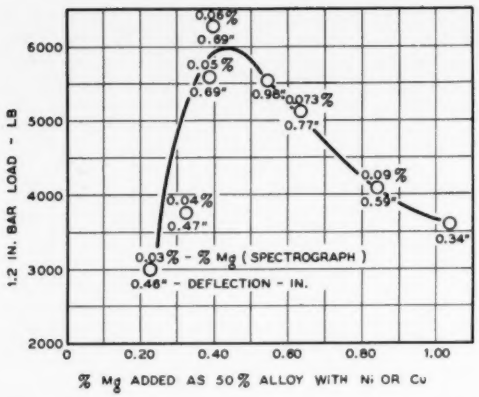



*Fig. 5—Relationship between percentage of Mg added and breaking load, 1.20-in. bar, low phosphorus iron.*

In Heat I-346, comparison is made between two inoculants: 75 per cent ferrosilicon and a granular graphite inoculant (BB-7). Where the graphite inoculant was used (ladles 2 and 3) the graphite was entirely flake. Where no inoculant was used the iron was again mottled. Apparently, use of the graphite type of inoculant after the magnesium caused a reversion to the flake type of graphite structure.

Some tests were made where the magnesium and the ferrosilicon were added simultaneously. Although nodular graphite is formed by this procedure, repeated checks indicate that the structure and properties are slightly inferior to those obtained where silicon is added after the magnesium (Fig. 4).

### Optimum Magnesium Content

The preliminary testing of various magnesium treatments heretofore discussed was carried out on short one-in. diameter test bars. With this specimen, tensile strength, Brinell hardness and microstructure are obtained. Another test specimen used to evaluate nodular graphite irons is the ASTM standard 1.20-in. diameter bar tested transversely on an 18-in. span (Fig. 2). Several bars of this type were cast and tested with varying additions of magnesium to several base irons. If we consider only the low phosphorus (0.10 per cent max.) irons, and only those treated with the 50 per cent Cu-Mg or Ni-Mg alloys, plotting the percentage of magnesium added vs. breaking load of the bar gives the relation shown in Fig. 5.

It is apparent that amount of magnesium is critical. With too little magnesium micro-examination shows partially flake graphite structures, and with too much magnesium the structures contain free carbides. It is seen that high strengths are associated with high ultimate deflections, and that the optimum magnesium content for this iron is about 0.05 to 0.07 per cent. With this base iron we can feel reasonably confident of obtaining superior properties with additions of 0.35 to 0.60 per cent of magnesium. Similar correlation with magnesium added was developed for several base irons, whence is derived the curves of Fig. 6 showing effect of phosphorus content on properties.

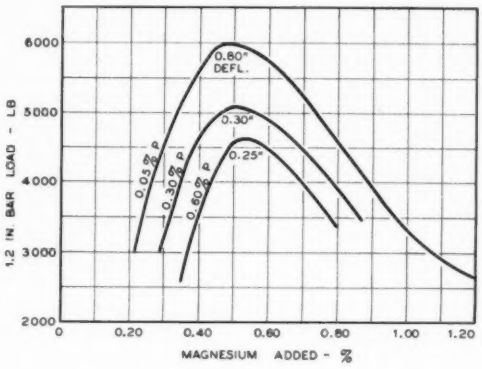



*Fig. 6—Idealized diagram showing effect of phosphorus content on properties of magnesium treated irons.*

TABLE 3—EFFECT OF INOCULATION

| Heat No. | TC | Si | S | Mn | P | Mg | Ladle Additions, per cent | Tensile Strength, 1000 psi. | Bhn |
|---|---|---|---|---|---|---|---|---|---|
| I-347-1 | 3.15 | 2.11 | 0.033 | 0.72 | 0.07 | 0.052 | 0.60 Mg as Ni-Mg (50-50)<br>0.40 Si as FeSi | 95.3 | 255 |
| -2 | 3.20 | 2.12 | 0.035 | 0.69 | 0.07 | 0.042 | 0.60 Mg as Mg Scrap<br>0.40 Si as FeSi | 93.8 | 255 |
| -3 | 3.25 | 2.08 | 0.039 | 0.68 | 0.07 | 0.065 | 0.60 Mg as Ni-Mg (50-50) | Hard to machine | 352 |
| -4 | 3.15 | 1.99 | 0.037 | 0.75 | 0.07 | 0.045 | 0.60 Mg as Mg Scrap | Hard to machine | 352 |
| I-346-1 | 3.03 | 2.18 | 0.045 | 0.71 | 0.15 | ... | 0.50 Mg as Ni-Mg (50-50)<br>0.40 Si as FeSi | 93.2 | 269 |
| -2 | 3.12 | 1.88 | 0.052 | 0.74 | 0.15 | ... | 0.50 Mg as Ni-Mg (50-50)<br>0.75 Carbon as Graphite | 33.6 | 187 |
| -3 | 3.13 | 2.21* | 0.053 | 0.57 | 0.15 | ... | 0.50 Mg as Ni-Mg (50-50)<br>0.75 Carbon as Graphite | 26.1 | 149 |
| -4 | 3.10 | 2.21* | 0.050 | 0.60 | 0.15 | ... | 0.50 Mg as Ni-Mg (50-50) | Hard to machine | 331 |

*Si increased about 0.40 per cent in crucible.

TABLE 4—EFFECT OF HOLDING TIME

| Heat No. | TC | Si | S | Mn | P | Mg | Ni | Additions, per cent: Crucible* | Additions, per cent: Ladle | Elapsed Time | Micro-Structure | Bhn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| I-356-1 | 3.24 | 2.39 | 0.043 | 0.83 | 0.08 | 0.052 | 0.35 | 0.60 Mg as Ni-Mg | 0.40 Si | ½ min | All Nodular | 269 |
| -2 | 3.24 | 2.39 | 0.043 | 0.83 | 0.08 | 0.029 | 0.33 | 0.60 Mg as Ni-Mg | 0.40 Si | 3½ min | 25% Nodular | 223 |
| -3 | 3.24 | 2.39 | 0.043 | 0.83 | 0.08 | 0.017 | 0.35 | 0.60 Mg as Ni-Mg | 0.40 Si | 6 min | 15% Nodular | 179 |
| -4 | 3.24 | 2.39 | 0.043 | 0.83 | 0.08 | 0.010 | 0.36 | 0.60 Mg as Ni-Mg | 0.40 Si | 10½ min | All Flake | 179 |

* Added at zero time to crucible.

It is suggested that the most fruitful approach for a foundry initiating experiments with magnesium treatment is to add varying amounts of magnesium or magnesium alloy to a given base iron to develop a relation such as shown in Fig. 5. With other variables—method and time cycle of additions and pouring conditions—held constant the optimum range of magnesium to be added is most readily determined.

### Effect Lost by Excessive Holding

Loss of the effect of the magnesium treatment by excessive holding in the ladle was suspected, since magnesium is oxidizable and since nucleation effects are notably evanescent. A test of holding time effect is shown in Table 4. The melt was held in the induction furnace at 2700F with the power on. A sufficient addition of magnesium was made to the melt and bars cast at intervals, with the ferrosilicon added to the separate ladles. After 10 min holding time there was less than 0.01 per cent Mg in the metal and flake graphite was formed on casting. (A companion test with cerium treatment showed a like disappearance of the effect with about the same holding time.)

TABLE 5—EFFECT OF SECTION SIZE—CAST 2748

| | TC | Si | S | Mn | P |
|---|---|---|---|---|---|
| Analysis | 3.08 | 3.26 | 0.019 | 0.44 | 0.02 |

Added to Ladle, 0.56% Mg as Ni-Mg (50-50) and 0.40% Si as FeSi.

| Bar Diameter, in. | Transverse Test: MR, 1000 psi | Transverse Test: ME, 1,000,000 | Tensile Strength, 1,000 psi | Bhn |
|---|---|---|---|---|
| 0.60 | 185.8 | 7.5 | 99.5 | 254 |
| 0.875 | 155.0 | 7.5 | 92.0 | 235 |
| 1.20 | 147.4 | 6.8 | 80.3 | 229 |
| 2.00 | 135.0 | 6.0 | 77.5 | 201 |
| 3.00 | 128.1 | 6.0 | 76.5 | 201 |

The conditions of maintained high temperature and contact with a hot silica crucible are much more conducive to rapid loss of magnesium than would be expected in normal foundry operations. It is well recognized, for example, that the effects of silicon inoculation disappear in 10 to 15 min if the metal is held at temperature in a furnace, while if the metal is continually cooling in a foundry ladle the effects last much longer. So in a foundry ladle we might expect to be able to hold magnesium-treated metal for 10 min

TABLE 6—KEEL BLOCK TESTS—Mg TREATED IRONS

| No. | Designation | Furnace | Ladle Additions, per cent | Analysis, per cent: TC | Si | S | Mn | P | Mg | Other |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Cruc. 6-4 | Crucible | 1.00 pure stick Mg<br>0.40 Si | 3.70 | 2.58 | 0.028 | 0.41 | 0.040 | ... | ... |
| 2 | I-343 | Induction | 0.75 Mg scrap<br>0.40 Si | 3.51 | 2.13 | 0.040 | 0.61 | 0.10 | ... | ... |
| 3 | 56838-1 | Arc | 0.44 Mg as Ni-Mg<br>0.40 Si | 3.42 | 2.81 | 0.031 | 0.60 | 0.027 | 0.039 | 0.34 Ni |
| 4 | 56838-2 | Arc | 0.56 Mg as Ni-Mg<br>0.40 Si | 3.48 | 2.74 | 0.032 | 0.58 | 0.029 | 0.050 | 0.40 Ni |
| 5 | 56832-1 | Arc | 0.625 Mg as Ni-Mg<br>0.40 Si | 3.50 | 2.59 | 0.028 | 0.53 | 0.10 | 0.080 | 0.60 Ni |

TENSILE TESTS—0.505-IN. BAR

| No. | As Cast: T.S. 1000 psi. | As Cast: Y.P. 1000 psi. | As Cast: El. % | As Cast: R.A. % | As Cast: Bhn | Annealed: T.S. 1000 psi. | Annealed: Y.P. 1000 psi. | Annealed: El. % | Annealed: R.A. % | Annealed: Bhn |
|---|---|---|---|---|---|---|---|---|---|---|
| | 92.0 | 60.0* | 9.4 | 7.5 | 180 | 70.2 | 46.1 | 21.5 | 19.6 | 152 |
| 1 | 93.5 | 60.0 | 8.1 | 6.5 | 186 | 69.9 | 45.8 | 17.8 | 18.1 | 141 |
| 2 | 82.5 | 49.2 | 11.2 | 9.8 | 170 | 69.6 | 45.1 | 20.4 | 19.6 | 143 |
| | 78.5 | 55.0 | 3.6 | 1.5 | 170 | 63.5 | 51.6 | 11.5 | 4.0 | 152 |
| 3 | 78.8 | ... | 3.8 | 3.5 | 187 | 64.1 | 54.0 | 8.9 | 7.0 | 156 |
| | 102.5 | ... | 9.0 | 7.5 | 207 | 77.0 | 54.0 | 20.3 | 23.5 | 170 |
| 4 | 101.0 | 62.6 | 6.7 | 5.5 | 212 | 76.0 | 54.3 | 18.6 | 23.2 | 163 |
| | 104.3 | 66.9 | 4.3 | 3.4 | 241 | 77.2 | 54.2 | 16.5 | 14.0 | 170 |
| 5 | 105.3 | ... | 4.8 | 4.0 | 229 | 75.9 | 54.2 | 14.9 | 12.7 | 163 |

* Approximate.

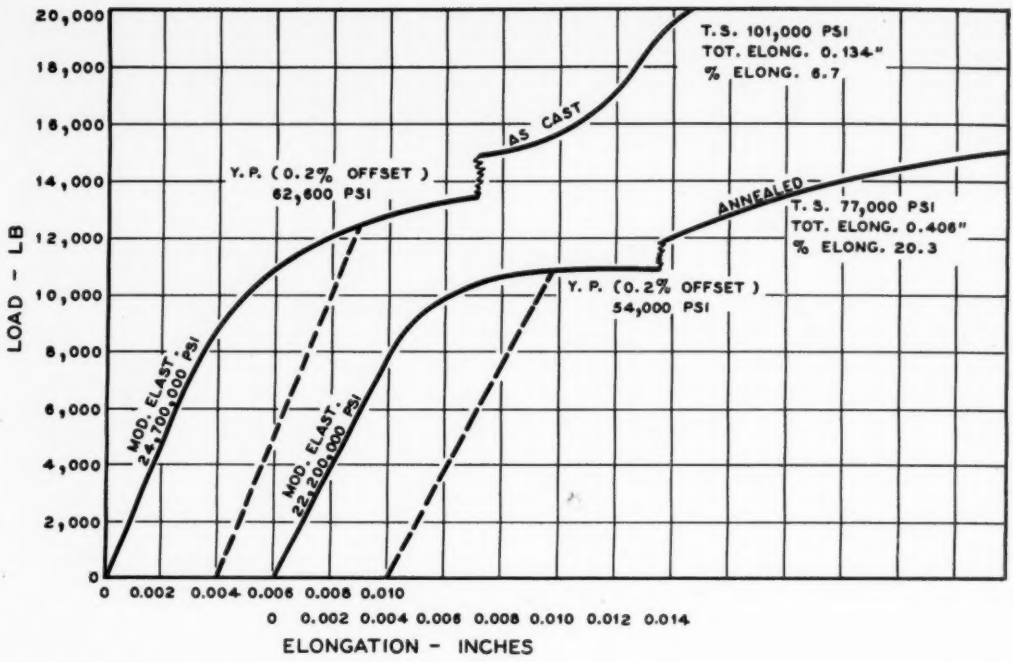



*Fig. 7—Graph showing tensile load—elongation curves for as-cast and annealed 0.505-in. diameter test bars, 2-in. gage length (Iron No. 4, Heat 56838-2, Table 5).*

or so without losing the effect, but it seems likely that the magnesium (or cerium) addition will always be a ladle treatment made just prior to casting.

A series of round transverse bars ranging from 0.6 to 3-in. diameter were cast of magnesium treated iron and tested transversely and in tension (Table 5). To enable direct comparison transverse strength is shown as modulus of rupture, and stiffness by the so-called "secant modulus of elasticity." It is apparent that strength and hardness fall off with increasing section size, but the decrease is quite gradual indicating somewhat less section sensitivity than would be expected in a normal cast iron.

### Keel Block Tests

Standard transverse and tensile tests for gray cast iron are performed on round bars usually cast without feed heads. Since the mechanical properties of nodular graphite iron are so superior to those of normal gray iron, it was decided to test the material as cast steel would be tested. From several ladles of magnesium treated iron, keel blocks of the type shown in the *Steel Castings Handbook*[3] were cast. The keel block legs, or coupons, were cut off and regular 2-in. gage length, 0.505-in. diameter tensile bars were machined from one leg and tested in the as-cast condition. The companion leg of each keel block was given a simple anneal—1650F, one hour, slow cool—and similar bars machined and tested. Data are given in Table 6.

Note that to the three arc-furnace irons (Nos. 3, 4, and 5) increasing amounts of magnesium were added. In No. 3 the magnesium content was insufficient for best properties; No. 4 was near optimum; and No. 5 had slightly excessive magnesium as evidenced by increased hardness and lower ductility.

Figure 7 shows the tensile load-elongation curves for as-cast and annealed tests on No. 4 of Table 5. These properties approach in quality those of cast steel, and are superior to the properties often given for malleable irons.

Some experimental casts of pressure pipe and fittings of magnesium treated cast iron have been made. Pipe in diameters from 8 to 16 in. have been cast and tested. Fittings from 6 to 24 in. in diameter and weighing up to 2500 lb were cast and tested to failure by bursting. Strengths generally were two to three times those obtained for similar castings of normal gray iron, but the toughness and impact resistance are even more impressive when the iron is completely nodular. The desired structure was not always obtained in these production castings.

In some instances, due to inexperience, too much or too little magnesium was added. In at least one case the iron composition, especially the sulphur, came out differently from that which had been expected. The degree of control testing necessary to insure uniformity in magnesium treated irons will be established only when the process comes into commercial production.

While the tests reported here indicate the possibilities of magnesium treated nodular graphite cast irons, from our point of view a great deal of development work remains to be done. First, the best method

of introducing magnesium into the iron in routine operation needs to be worked out. Should we simply toss pure magnesium into the ladle and run, or should we use a lean alloy in which the magnesium is greatly diluted? Or, are there still better methods? It is probable that more experience will give us the answer to these questions.

More complete data are needed with regular production cupola irons. While we have successfully treated several cupola irons, this data is more limited than with the more carefully controlled electric furnace or crucible irons.

Heat treatments should be studied further. We have shown very promising properties obtainable with a simple one-hour anneal at 1650F, but other temperatures and times should be investigated with other base irons. Perhaps the brittleness found in the higher phosphorus irons can be eliminated by suitable heat treatment. Some preliminary tests on quenched and tempered nodular irons have indicated that valuable properties may be obtained by this type of treatment.

The combination of magnesium treatment with other alloy additions should be studied. If the optimum graphite structure is produced with magnesium, alloying with other elements to produce the optimum matrix structure should produce optimum properties. Some tests on nodular graphite irons with acicular and austenitic matrices have shown very promising properties. Graphitizing inoculants other than ferrosilicon and granular graphite should be tried in conjunction with the magnesium treatment.

Such properties as wear, corrosion resistance, or damping capacity often determine the usefulness of a cast part rather than strength and ductility. These need to be evaluated for nodular graphite iron.

## Summary and Conclusion

1. High strength cast irons with the graphite in the nodular form are produced by incorporating in the order of 0.03 to 0.10 per cent of magnesium in the iron.

2. Pure magnesium and several magnesium alloys are effective in producing nodular graphite irons. Results were not effective with a few alloys.

3. Magnesium recovery and convenience of addition were found to be better with copper or nickel alloys of low magnesium content.

4. Advantages of magnesium treatment over cerium treatment are that magnesium is effective in low carbon, high phosphorus, and relatively high sulphur irons. The disadvantage of magnesium treatment is the difficulty and hazard of making the addition.

5. Ladle addition of a graphitizing inoculant (such as ferrosilicon) after the magnesium addition is useful for controlling the structure and machinability of nodular irons. A granular graphite inoculant, however, apparently caused reversion to flake graphite.

6. There is an optimum magnesium content for a given base iron, too little magnesium resulting in a mixed structure, and too much magnesium causing increased hardness and brittleness.

7. Excessive holding time after magnesium treatment may result in loss of magnesium and reversion to flake graphite.

8. The effect of section size, from 0.6 to 3.0 in., is not particularly critical in nodular graphite irons.

9. Tests on keel block test bars of magnesium treated cast irons gave strength-ductility properties superior to most malleable irons and approaching those of cast steels.

10. Much development work remains to be done on methods of addition, adaption to production, heat treatments, alloying, and special properties of the material.


## Acknowledgment

We are greatly indebted to the Dow Chemical Co., and especially to Frank Simons of the Magnesium Division, for valuable cooperation in supplying magnesium alloys and technical advice.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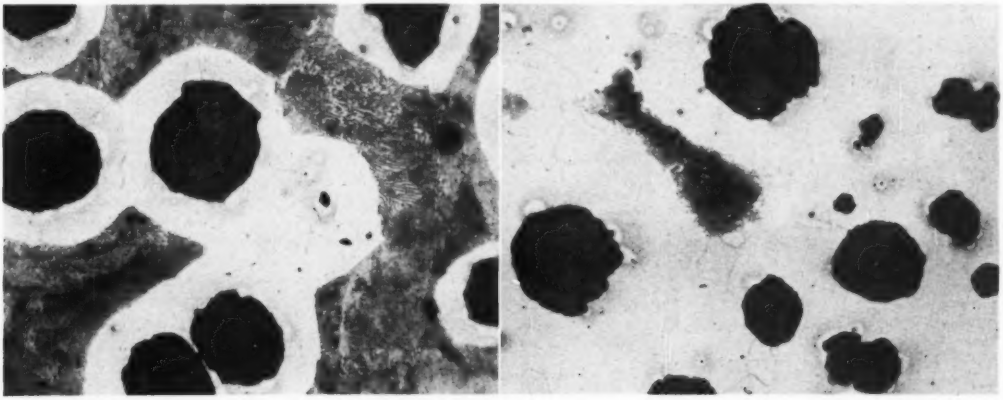
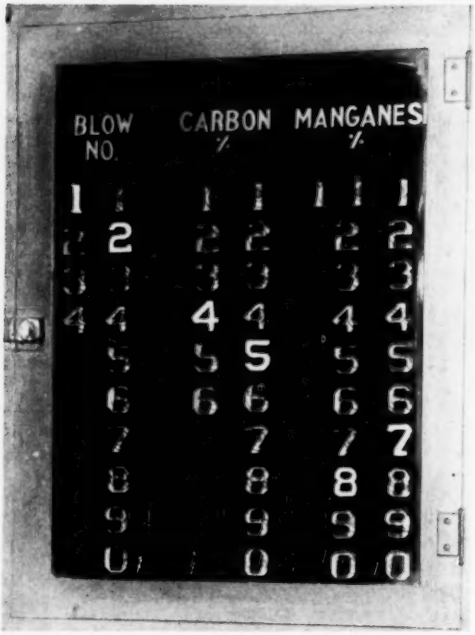
2. H. Morrogh, "Nodular Graphite Structures Produced in Gray Iron," AMERICAN FOUNDRYMAN, April, 1948, and A.F.S. TRANSACTIONS, vol. 56, pp. 72-90 (1948).

3. *Steel Castings Handbook*, Steel Founders' Society of America, Cleveland, 1941, p. 142.


*Fig. 8—Nodular iron structures (see graph of Fig. 7). Left—as-cast. Right—annealed. Etched X300.*



# MODERN FOUNDRY METHODS...




## STEEL "BLOW" ANALYSES TRANSMITTER

*In foundry organizations where the plant laboratory is located at a considerable distance from the melting floor various methods of transmitting analytical data from the laboratory to the melter—messenger, telephone, pneumatic system—have been employed.*

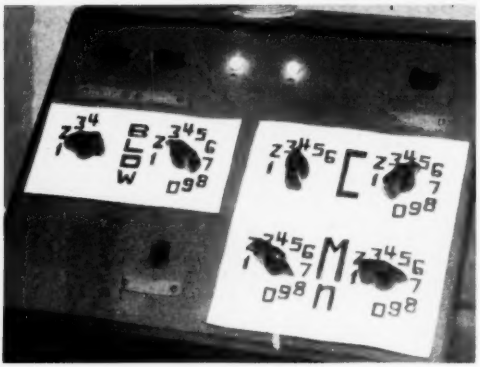
*Due to delays in transmitting analytical findings to the converter crew in the steel foundry of the American Hoist & Derrick Co., St. Paul, Minn., it became apparent that the analytical data were not being used effectively. To remedy this the electrical signal system between the laboratory and the converter floor, described by G. W. Johnson, metallurgist, was devised and installed.*

*The foundry signal board is arranged to show the Blow Number, and Carbon and Manganese percentages from dial settings in the laboratory; the photograph shows Blow 12; C, 0.45; Mn, 0.87. In this plant the laboratory is located about 100 yards from the blower floor. Approximately 15,000 ft of bell wire were required to connect the 51 individual flashlight bulbs in the signal board to the laboratory dials. In addition to the signal board, a large 110-V lamp is prominently mounted in the foundry and connected to the switch labelled "bad blow." This signal, visible to both the blowing and pouring crews, calls attention to any blow of steel so off-grade that the castings must be segregated before shakeout and properly identified.*

*The two bulbs shown on the laboratory board indicate to the sender that the message is illuminated on the receiving board in the foundry. A two-way switch connected to this line allows the converter operator to cut off the two lights on the laboratory dial along with the lighted bulbs in the receiving panel, thus clearing the signal board for transmission of the analytical data on the succeeding blow.*

*Signal board mounted in the blower room. The illuminated numerals indicate—Blow 12; Carbon, 0.45; Manganese, 0.87.*

*Transmitting the analytical data from the laboratory to the blower room signal board.*



*Close-up of the dial faces on laboratory signal apparatus.*

# ...MODERN FOUNDRY METHODS

## GRAPHITE CHILL BLOCK

*Extruded graphite blocks, 8x8x18 in., were found to have several advantages over cast iron or steel chills in promoting rapid cooling of cupola iron test bars:*

*1. Constant surface characteristic. Graphite is an extremely rapid conductor of heat. Metals such as cast iron solidify before there is time for any appreciable absorption of graphite by the metal. The graphite chill must not be exposed to air for prolonged periods at temperatures in excess of 800 F, above which temperature oxidation is accelerated. Usually, a sufficiently large chill will prevent elevated temperatures. Further stability of the conducting surface is derived from its homogeneity. The graphite does not break down due to phase changes such as would occur with steel or gray iron.*

*2. Metal does not adhere to graphite. Therefore, it is not necessary to use "partings" which would lower the conductivity.*

*3. Water cooling is eliminated. In many applications where a large number of pieces must be cast over short periods, water is used to cool metal chills. Graphite has high conductivity and light weight, permitting chills of sufficient size to dissipate heat without water cooling.*

*Graphite is quite soft compared to metals used for chill purposes. Metal protective frames must be used in applications where the graphite block is subject to rough usage. The dry sand molds score the graphite surface of contact as they are placed in and removed from the holders. However, once a month after 2200 lb of test bars have been cast, the metal holders are removed and the plane surface of the graphite restored by rubbing with emery cloth.*

*The photograph shows a graphite block adapted for test bar chilling, as used in the foundry of Buick Motor Div., G.M.C., Flint, Mich., and described by W. F. Bohm, metallurgist.*

## FORK TRUCK DUMP HOPPER

*A bottom-dump hopper fitted to a fork truck serves an Eastern foundry as an extremely flexible casting and material handling unit. With this equipment it is possible to transport and load castings into hoppers and chutes at heights several feet above floor level. The dump hopper is basically a square metal skid bin, with the bottom hinged on one edge, and the sides, integral with the bottom, bent up along the two sides of the bin. The degree of bottom opening is limited by chains secured to the bin sides and bent bottom sides. A hook, welded to the back of the bin, is used to hang the hopper from a notched member welded to the top of the truck lift frame. The hopper is dumped by lowering the fork, thus releasing the hopper and permitting close control of the material flow. As illustrated, a load of castings is being dumped into a tumbler after the loaded hopper had been picked up and transported by the fork truck.*

# RECLAIM FERROUS FOUNDRY SAND

**E. C. Jeter**
**Foundry Supt.**
**Ford Motor Co.**
**Dearborn, Mich.**

DURING THE PAST FEW YEARS many foundries engaged in ferrous casting have become interested in the possibilities of molding and core sand reclamation. They are motivated for the most part by the economic factors involved in obtaining suitable sand for cores and other dry sand work. Other factors are the physical difficulties arising from moving sand into the plant and disposing of the waste after it has been used in only one casting cycle.

Winter sand storage for large foundries is a task of great magnitude. Due to the amount of sand necessarily stored, many large foundries do not have facilities to protect the sand pile from the weather; nor do they have adequate drying facilities. The result is the use of a sand varying in moisture content, which condition causes numerous difficulties. Large foundries located in cities pay considerable service charges for hauling waste sand to dumps. In some cases, this cost is higher than the original cost of the sand at the pit.

Foundries presently interested in sand reclamation do not have to proceed entirely without precedents. Several foundries have installations for sand reclamation which are operating successfully from the economic standpoint. Some have been in operation for several years, and these foundries are to be commended for their boldness and foresight. Information which they have freely given the industry has been valuable as an aid to foundries considering sand reclamation.

During the war many of the large aluminum and magnesium foundries for aircraft castings had sand reclamation units. This reclamation was accomplished by roasting the sand at temperatures of 1300-1500 F. Cores or molds made from this reclaimed sand were entirely satisfactory. The roasting of this sand was done in vertical furnaces with horizontal hearths, and also in rotating horizontal furnaces. Both furnace types proved satisfactory and, except perhaps for maintenance, there would be little preference.

When it was decided at the writer's plant to investigate further the possibilities of a sand reclamation system for the gray iron foundry, the first experiments consisted of roasting the used sand and removing the loose fines. A suitable particle distribution was obtained, but tensile strengths were found to be only 70-80 per cent of new sand strengths, using the same amount of oil. Increasing the oil content did increase physical properties, but not to any safe level. Further oil additions would not be the proper answer even if tensile strength had been brought to a suitable level.

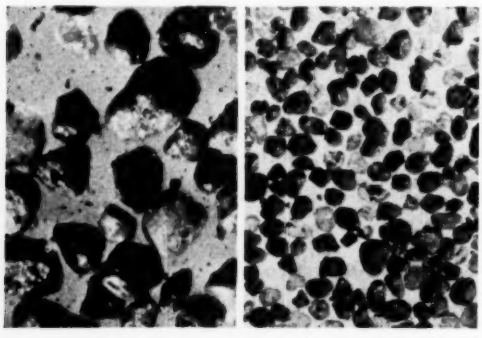
### Roasting Ferrous Foundry Sand

Roasted sand was also screened, and a synthetic classification arranged by adding suitable percentages of different grain sizes. The screen analysis was then brought to that of the new sand presently used. Physical properties still were not in line with those of new sand. Other attempts were made by washing the roasted sand, but without success. It was apparent that a more complete treatment than mere roasting or washing was required. Other foundries had also found this to be the case.

That the method of reclamation of sand by roasting only is entirely satisfactory for aluminum and magnesium foundries has been proved by experience. That this same method is not satisfactory for ferrous foundries has been proved by numerous experiments. Why, then, should this be true? To the writer's knowledge, there is no evidence of sufficient cleavage of sand particles in either the casting or roasting operations to account for this condition.

The answer can be found, upon microscopic examination, to be not in the condition of the sand grains themselves, but the deposit on these sand grains. Examination of a roasted sand from a ferrous foundry reveals a close-fitting clay coating. This is not present to any great extent on non-ferrous foundry sand.

Aluminum and magnesium foundries do not add clays to the sand to any large extent. Therefore, the amount of fine clay present is inconsiderable. The aluminum and magnesium foundries practicing reclamation by roasting use a minimum amount of green



| PHYSICAL PROPERTIES | |
|---|---|
| FUSION °F | 3056 |
| % IGNITION | 2.5 |
| % FINES | 1.8 |
| % RET. ON 3 ADJ. SCR. | 90 |
| A.F.A. | 48.7 |
| % CLAY CONTENT | 2.0 |
| STD. PERM. | |
| CORE TENSILE LB/SQ" | |
| DEEP JKT.* | |
| SHALLOW JKT.* | |
| *(15% SHARP SAND ADDED) | |

| SIEVE NO. | % |
|---|---|
| 6 | |
| 12 | |
| 20 | |
| 30 | |
| 40 | 7.8 |
| 50 | 42.0 |
| 70 | 40.2 |
| 100 | 6.0 |
| 140 | 2.2 |
| 200 | 1.3 |
| 270 | |
| PAN | 0.5 |
| TOTAL | 100.0 |

*Refuse sand from block section of production foundry. X20 (left) and X10 (right). Physical properties and screen analysis chart for this sand are shown above.*

sand; in fact, some have no green sand at all in the molds. Clay does accumulate to some extent through contamination with whatever green sand is present, but the casting temperatures are so low that there is no sintering of clay to sand grains.

The ferrous foundry, on the other hand, adds clay to its dry sands; also, a greater possibility of contamination with green sand exists. Many castings contain only small cores, the larger percentage of the mold being green sand which becomes mixed with the spent dry sand at the shakeout. The temperature reached in casting in the ferrous foundries is sufficiently high to sinter clay onto the sand particle surfaces.

Closely adhering clay coatings on sand grains cut down binder effectiveness. It then becomes necessary in any reclamation unit to provide some means for dislocating and removing the close-fitting clay coating, as well as removing oil and classifying sand grains.

In order to obtain satisfactory reclaimed sand it is necessary to accomplish the following:

a. Partially oxidized binding oil and carbonaceous matter must be removed from the sand grains.

| PHYSICAL PROPERTIES | |
|---|---|
| FUSION °F | 2960 |
| % IGNITION | 0 |
| % FINES | 14.1 |
| % RET. ON 3 ADJ. SCR. | 79.9 |
| A.F.A. | 84.7 |
| % CLAY CONTENT | 0.55 |
| STD. PERM. | 105 |
| CORE TENSILE LB/SQ* | |
| DEEP JKT.* | |
| SHALLOW JKT.* | |
| *(15% SHARP SAND ADDED) | |

| SIEVE NO. | % |
|---|---|
| 6 | |
| 12 | |
| 20 | |
| 30 | |
| 40 | |
| 50 | 0.6 |
| 70 | 30.3 |
| 100 | 21.3 |
| 140 | 25.3 |
| 200 | 10.3 |
| 270 | |
| PAN | 3.8 |
| TOTAL | 100.0 |

b. Loose fines must be separated and removed in order to maintain proper grain size.

c. Sintered clay coatings on sand grains must be dislocated and removed.

d. Sand to be delivered to coreroom at proper moisture content.

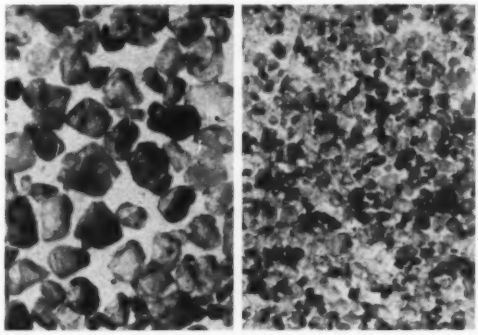
### Reclamation Methods Developed

Two distinct methods of reclamation have been developed to accomplish the foregoing requirements. One is the wet method of scrubbing and classification, and the other is the roasting and dry scrubbing method. The wet method is now in use and has actual operating experience behind it. The dry method has only numerous experiments behind it. Basically, this method consists of impinging the sand grains upon each other or on a baffle to loosen the coating film of clay.

An experimental installation for accomplishing dry clay removal in the writer's company is shown in the accompanying photographs. The air is distributed into four nozzles from the manifold shown at the top of the photograph. Sand is admitted at a controlled rate to the air stream to be carried into the unit. It was found that the minimum velocity to produce the abrasion required for successful clay removal was about 8,000 fpm.

Either method, however, can be made to accomplish the four requirements to varying degrees. The removal of the oil and carbonaceous matter can be accomplished by roasting or, as the advocates of wet reclamation advise, by wet scrubbing. Loose fines can be removed by both wet and dry classification. The fixed coatings can be dislocated by wet or dry scrubbing. These would then be separated and removed by the same classification method used to remove loose fines. This operation of scrubbing either wet or dry is the point on which a sand reclamation system for a ferrous foundry differs from that for an aluminum or magnesium foundry.

The problem of a foundry contemplating sand reclamation is to weigh all the evidence and select the system best suited to the conditions. Wet reclamation is an already accomplished fact and, to the writer's knowledge, no other method is now in production in a ferrous foundry.

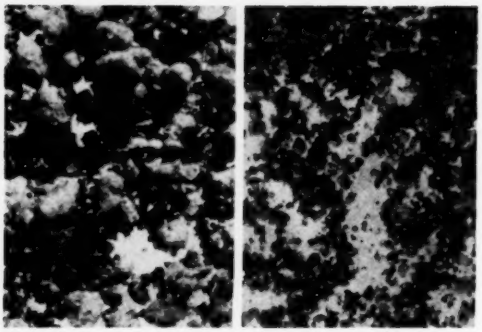


*Roasted, jet scrubbed, and classified fine sand from block and small parts sections of foundry. X20 (left) and X10 (right). Physical properties chart is at left.*

Wet reclamation of sand has been adequately described by Rengering and Horth,[1] and Webster and Den Breejen.[2] By this method sand is taken from the shakeout, screened and pumped suspended in water to a reclamation station. There the sand is again screened and metallic particles removed. After this the sand is dewatered and wet scrubbed in a muller or other suitable unit to remove oxidized oil and clay coatings. Sand then goes to the wet classifier where undesirable fines and dislocated clays are removed. The re-usable portion is pumped to a centrifuge where excess water is removed. Remaining water is removed in a rotary or other suitable dryer, and the sand is then ready for use.

The clay sludge, suspended in water removed at the classifier, is pumped to a water clarifier where settling takes place, and the water is re-circulated through the system.

Sand reclamation by the dry method has been described by W. L. Hartley.[3] Here the sand from shakeout is crushed, metallic particles removed mag-



*Dust from the collector in exhaust system of the jet scrubber. X20 (left) and X10 (right). Physical properties and the screen analysis chart are shown below.*

| PHYSICAL PROPERTIES | |
|---|---|
| FUSION °F | 2460 |
| % IGNITION | 0 |
| % FINES | 36.5 |
| % RET. ON 3 ADJ. SCR. | 56.8 |
| A.F.A. | 113.3 |
| % CLAY CONTENT | 16.0 |
| STD. PERM. | 0 |
| CORE TENSILE LB/SQ" | |
| DEEP JKT. * | |
| SHALLOW JKT. * | |
| *(15% SHARP SAND ADDED) | |

| SIEVE NO. | % |
|---|---|
| 6 | |
| 12 | |
| 20 | |
| 30 | |
| 40 | |
| 50 | 6.7 |
| 70 | 24.6 |
| 100 | 10.3 |
| 140 | 21.9 |
| 200 | 19.1 |
| 270 | |
| PAN | 17.4 |
| TOTAL | 100.0 |

netically and the sand conveyed to the roasting oven. This oven may be a horizontal roasting kiln or a vertical furnace with rotating horizontal hearths. Operating temperatures are between 1300 and 1500 F. All oxidized oil and organic matter are removed by burning in this operation. Sand from the roaster is then cooled and dry scrubbed by a speed muller operation for approximately 5 min. The dry scrubbing will dislocate fixed clays.

Separation and removal of these clays, plus the already loose fines, can be accomplished during this mulling operation by pulling air through the muller at a vacuum of approximately one ounce per square inch. Fine clays and fine sand particles will be removed. These fines can again be separated and fine sand recovered for re-use as blending sand. Coarse sand, or sand that remained in the muller, is sent to foundry for re-use as dry sand, ready for mixing with oil and making cores.

Another possibility in the separation and removal of the fines from the dry scrubbed sand is to separate them in a dry classifier after, and independently of, the mulling operation. In this case no vacuum would be applied to the muller; it would be used merely as a physical scrubber.

### Quality and Reclamation

Many foundries making large castings, in which there is a large percentage of internal cores, have adopted the wet shakeout method. By this method internal cores are broken up and removed from castings by a high-pressure stream of water and sand. It seems logical that these people would then decide to reclaim this sand by a wet method, as the sand is already wet at the shakeout. That this method of reclamation has proved satisfactory for these foundries cannot be disputed.

It has not been conclusively proved, however, that this same method of wet reclamation would be satisfactory for a foundry making smaller castings with many intricately shaped and thin-section cores. The foundry making castings with the smaller cores does not employ wet shakeout methods. For instance, the foundry making automotive cylinder blocks removes the spent internal core sand by dry methods. Castings are vigorously vibrated and dry air is used to blow out loose sand. The outside and accessible inside portions of blocks are shot blasted, but this blast does not reach the water jacket and other sections.

The nature of the core sand mix for these intricate and light cores is such that the core must collapse and disintegrate into loose flowing sand particles so that complete removal from castings is assured. When first made, these cores of light sections must be strong enough to withstand rather rough production handling. Cores are handled many times as they are pasted together into various assemblies and finally assembled into molds for casting. During the casting operation this core must withstand metal erosion, penetration and other conditions imposed upon a small core completely surrounded by metal.

Large chunk-like cores do not require the strength of section that the much-handled small core must have and, because they are accessible to means of removal after casting, high collapsibility is not required. Clays and strengthening agents may be added to sand for large cores in sufficient quantities to assure proper green and dry strengths. Because most of these clays impart to some extent the property of poor collapsibility, they cannot be added in as great a quantity to the small cores which virtually have to remove themselves from intricate recesses after the casting operation.

Automotive and related foundries use many cores which require sand of high quality. A reclamation method for these foundries must be capable of producing a sand with properties closely approaching those of new sand. Would such a method, satisfactory for certain cores and foundry conditions, be satisfactory for all foundry conditions?

A sand reclamation system, if it is to produce an acceptable sand, must be capable of removing the spent oil or other binder, dislocating and separating the clinging clay, and removing the loose fines.

A wet reclamation method depends on the physical scrubbing of the sand grains on one another to loosen and dislocate the spent oil and clinging clays. Can it be assured that sand used over and over will not accumulate some spent oil and carbonaceous matter together with sintered clay because the smaller grains and some of the recesses in the grains were not vigorously scrubbed? The dry method, which burns the oil and carbonaceous matter, certainly would assure

that this material would be completely removed each time the sand went through the reclamation system. It would be necessary to depend on dry scrubbing for removal of clay sintered on the grains, but the amount of material to be dislocated by scrubbing would be less.

Classification of the sand and removal of the dislocated and already loose clay can certainly be done well by the wet method. It is hardly possible that any dry method of classification or separation can approach the wet method for quality and completeness in this respect. Dry classification has been accomplished successfully on a small scale by pulling off fines with vacuum during dry scrubbing in the muller, and also by separation after scrubbing in an independent unit. However, there is no production experience back of these methods.

### Physical Considerations

In the wet method of reclamation, the sand will be handled wet during the entire reclamation procedure until it is dried just before delivery back to the foundry. This probably appeals to the foundry with the wet shakeout. To the foundry with dry shakeout, this would mean wetting the dry sand and redrying before use, a procedure which will not appeal to some foundries.

The dust problem is, of course, greatly reduced with the wet system. Engineers have a real problem in handling the dust with the dry method. Dust will be manufactured during the separation process if muller scrubbing and separation is used. This dust, which is the dislocated and loose clay, must be collected, and the cleaned air used for the separation must be discharged. If the separation is done by other means after only scrubbing in the muller, the large volume of air and dust would not have to be handled. In either case, the incidental dust would have to be properly handled.

A self-contained separator unit, in which turbulence of the air is created by the action of the separator, has been used for the classification operation after dry scrubbing in the muller. As the separator uses no actual volume of air, the problem of handling discharged air is eliminated.

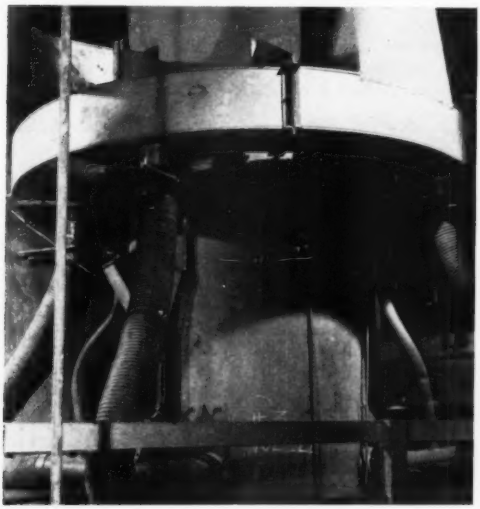
Clay from these separation processes and from the dust collection system can be disposed of as a dry waste. There is also a possibility that some of the material might be used for blending or bonding.

A wet reclamation method does not create a dust problem. However, there is the problem of the large amount of wet fine clay that accumulates in the settling tank. A small foundry might dump clay-laden water into a stream. A large foundry in or near a large city could not do this without eventually clogging up such a stream. Foundries located near or in cities generally do not have dump space for refuse water and clay. If the clay is allowed to settle out completely and is then removed as mud, it will freeze in the winter. For this reason, it is necessary in some cases to dry the sludge or clay refuse.

### Conclusion

Available cost figures indicate that the wet reclamation system is somewhat less expensive to install and operate than the thermal and dry scrubbing process. It is the writer's opinion that it is almost impossible to make a comparison of operation costs of the two methods, as there are no complete dry methods in operation on which to base concrete figures. Rather than get into a controversy over this, suffice it to say that either method would in all probability prove economical for the foundry having a remote source of sand supply and any difficulty in disposing of spent sand.

In considering reclamation of sand it seems logical that sand reclamation should be performed in foundries of any considerable size. It matters not by what method this reclamation is accomplished, so long as



*Experimental installation for dry removal of clay from sand grains. Minimum air velocity required for removal of clay by abrasive action is about 8,000 fpm.*

it is the one best suited to that particular foundry.

Most of the materials used in the foundry, except coke and other materials consumed, are re-used.

Core wires are straightened and re-used to considerable extent. Gates and risers are remelted. Green sand is re-used over and over with merely a tempering process to rejuvenate it. But dry sand is discarded after only one cycle of casting, and in many foundries a service charge is paid for disposal. It is logical that this sand should be re-used.

Now that reclamation methods are actually available many foundries are going to reclaim sand. It is most certain to be economical unless a foundry is so fortunate as to have a natural sand pile virtually within its own yards. Higher quality will be obtained by reclamation because the sand will be delivered dry from the reclamation unit. Grain size control can also be accomplished.

Many foundries have used inferior sands because of the economic factors involved in the procuring and shipping of quality sands. With a reclamation unit in operation, these foundries can perhaps afford to use the more expensive sands, with a resultant increase in quality of castings.

### References


1. W. Rengering and W. Horth, "Reclaiming Sand by the Wet Method," *Iron Age*, July 6, 1944.
2. R. Webster and A. C. Den Breejen, "Sand Reclamation," AMERICAN FOUNDRYMAN, Aug., 1945, pp. 49-57.
3. W. L. Hartley, "Thermal Process of Core Sand Reclamation," A.F.S. TRANSACTIONS, vol. 51, p. 207 (1943).


# A.F.S. RESEARCH PROJECTS

Research projects of A.F.S. are conducted under definitive contracts with various institutions which have the necessary personnel and mechanical facilities. Reports on each project are required at regular intervals.

"Research" is just that—*search* and *re-search*. It is not like production where reasonably well-known materials, proved methods and engineered designs are employed to turn out salable products. Research commences with an idea and many unknown factors, all of which must be examined by trial and error before the actual idea itself can even be approached.

Months or years may go by before a technique can be evolved which might be expected to shed light on the problem. Finally, a great many tests must be run before the researcher can arrive at useful conclusions. These must be interpreted and further analyzed in terms of actual production for the eventual benefit of the industry.

Results of A.F.S.-sponsored research, when in publishable form, are available to everyone. Quarterly progress reports and visits and consultation with the researchers keep the committees directing the work informed on project developments. Following the lead of the Sand Research and the Heat Transfer Projects, annual reports on the various researches under Society sponsorship will become a regular feature of the Annual A.F.S. Convention and will subsequently be published in TRANSACTIONS OF A.F.S. Some of the annual reports will also be preprinted, some will be available as special publications.

Newest A.F.S.-sponsored research projects were set up following authorization of the general plan by the Board of Directors in July, 1946. First public reports on five projects will be made May 2-5 at the Annual A.F.S. Convention.

The eight research projects actively under way are tabulated below under title, A.F.S. group directing the work, the amount of money appropriated for the project for the fiscal year, and the place where the investigation is carried out. As a service to A.F.S. members research news will appear monthly.

| Title of Project | Group Directing Work | Appropriation | Institution |
|---|---|---|---|
| Hydraulics of Light Metal Flow into Molds | Research Committee, Aluminum and Magnesium Division | $6500 | Battelle Memorial Institute |
| Fracture Test as an Index of Melt Quality | Research Committee, Brass and Bronze Division | $5000 | University of Michigan |
| Centrifugal Casting of Light Metal Alloys | Centrifugal Casting Committee, Aluminum and Magnesium Division | $1000 | Canadian Bureau of Mines |
| Influence of Heredity on Coke Behavior in the Cupola | Cupola Research Committee | Special Fund | U. S. and Canadian Bureaus of Mines, Ford Motor Co., and Eaton Mfg. Co. |
| Fundamentals of Heat Flow During Casting Solidification | Heat Transfer Committee | $2000 | Columbia University |
| Selective Hardening of Pearlitic Malleable Iron | Research Committee, Malleable Division | $5000 | University of Michigan |
| High Temperature Properties of Molding Sands | Research Committee, Sand Division | $6000 | Cornell University |
| Relation of Cores to Hot Tearing | Research Committee, Steel Division | $5000 | Armour Research Foundation |

# PROMOTING RISER FLUIDITY

**E. D. Boyle**
**Master Molder**
**Puget Sound Naval Shipyard**
**Bremerton, Wash.**

DIRECTIONAL SOLIDIFICATION in ferrous and non-ferrous castings can be controlled by the use of insulating material. In recent casting feeding experiments at the Puget Sound Naval Shipyard the use of diatomaceous earth as a basic insulating material was investigated.

In powdered form the diatomaceous earth is used as a liquidizer for many ferrous and non-ferrous castings. When bonded with bentonite and a small amount of phenolic resin, it may be formed into insulating sleeves and collars, neckdown risers, and contour antichill or insulating pads. The formed material is dried for periods of one to 4 hr. after being shaped.

When used as pads and riser sleeves, the diatomaceous earth material greatly increases feeder efficiency. Although no figures are available for steel, yields of over 80 per cent have been obtained with other alloys. This is particularly interesting to the non-ferrous foundryman who, in his efforts to reduce extreme gating, is often forced to use large top heads.

Preparation of the proprietary material—sintered diatomaceous earth—consists of grinding in a muller-type mill to pass a No. 8 sieve. That part of the material to be used in forming shapes is mixed in a muller with the following ingredients:

| | | |
|---|---|---|
| Ground Diatomaceous Earth (2 gal) | | 3¾ lb |
| Bentonite (2 pt) | | 12 oz |
| Resin (1 pt) | Resin | 160 gr |
| | Alcohol thinner | 240 gr |
| Water | | 2 qt |

Insulating pads are used at thin sections of a casting to retard solidification and allow the metal to feed through to heavier sections. The resin-bonded material is quite plastic, and is easily shaped by forming with the hands against the area of the pattern corresponding to the casting section requiring the antichill. After forming, nails or rod anchors are inserted.

Excellent results have been obtained with this material on stainless steel, copper-nickel alloys, cast iron, manganese bronze and other bronzes. On stainless steels and copper-nickel castings, a neck-down riser is used; on cast iron an insert core is used. Manganese bronzes were cast with an insulating sleeve, and also with insert cores, and the powdered material in the feeder heads. Insert cores are particularly effective in maintaining air-permeable passage for admission of atmospheric pressure to the heart of blind feeders, especially on nickel-copper castings where the tendency of blind risers to skull over is pronounced.

The opinions expressed in the paper are those of the author and do not necessarily reflect the views of the Navy Department.

*Fig. 1—Various types of cores, sleeves, hot-tops, and insulating pads made with diatomaceous earth.*

The Navy Department has been particularly active in the investigation of insulating materials in connection with non-ferrous foundry practices. Increasing emphasis on inspection and the development of improved inspection tools have focused attention on serious shortcomings in some castings. The more strenuous performance demands have caused an increased number of failures, and some replacement castings have proved failures.

By far the greatest number of service failures is the result of gassy material due to improper melting or wet sand. Sometimes impurities or improper compositions are blamed, and occasionally shrinkage caused by inadequate feeding is found. Research on risering of castings indicates definite limitations upon the ability of risers to feed the casting adequately unless great care is taken in the positioning and proportioning of gates and risers.

### Forms of Shrinkage Cavities

Several forms of shrinkage occur in castings made in steel, aluminum, and manganese bronze. Broadly speaking, these can be divided into two main groups—macroshrinkage and microshrinkage.

Macroshrinkage is the form of shrinkage resulting from a shortage of feed metal. The cavities are visible to the naked eye and vary in size in relation to the shortage of feed metal. In general, this larger form of shrinkage can be overcome by proper gating and feeding practice.

Microshrinkage is a looseness of structure resulting from microscopic voids. Many variables control its occurrence and concentration. These variables are solid-

ification range, casting design, gas contents, etc. The method employed to eliminate this type of porosity depends on the cause.

Other forms of shrinkage do occur. For instance, centerline shrinkage in steel consists of interconnected voids occuring more or less in the center of a solidifying mass where side-wall effects have been pronounced. Centerline shrinkage has two characteristics—position and direction. In vertical planes the shrinkage occurs at the center, while the closer a section approaches the horizontal the greater is the tendency of the centerline

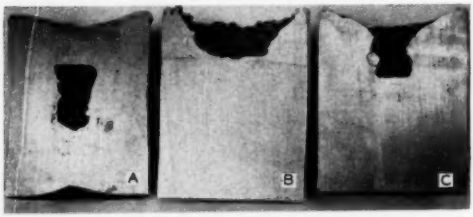



*Fig. 2—Sectioned billets of nickel-copper alloy, 5-in. diameter. "A" was poured without top insulation; "B" had one-inch top of diatomaceous earth; and "C" an application of exothermic riser-covering.*

shrinkage to move near the top facing. The formation of the shrinkage voids usually is of the "V" type and away from the feeder head.

Centerline shrinkage decreases the mechanical properties and also renders the castings unsound to hydraulic pressure tests. This form of shrinkage usually can be overcome by controlling directional solidification. A form of macroshrinkage presenting many foundry problems is caused by hot spots. The occurence of hot spots is a source of annoyance in that chills must be used in eliminating them. A change in casting design or gating method will often help reduce the problem.

Any liquid metal cooling in a cavity formed in a refractory mold will solidify progressively from the mold-metal interface toward the center of the cavity and, in addition, solidification will proceed along the cast member in the direction of the increasing temperature gradients produced in pouring the casting. Temperature gradients along the cast member appear in both the metal and the mold, and are determined by the shape of the mold cavity and the method of gating and heading. They are, therefore, controllable. Shrinkage cavities are the result of adverse temperature gradients and uncontrolled directional solidification.

A casting with a 60 per cent yield requires a feeder head of 40 per cent. This feeder head is made up of (a) the mass of metal required to offset premature freezing of the head, and (b) the quantity of metal required to compensate for liquid shrinkage.

Assuming that the compensation requirement is 20 per cent, then 80 per cent of the feeder head metal is used to prevent, by mass effect, its premature freezing. This means that 20 per cent of the riser is used for liquid shrinkage requirements. If the rate of solidification of the riser could be retarded, the amount of metal required to offset premature freezing could be reduced.

Manganese and aluminum-bronze castings are notable in this respect, and gypsum-insulated heads have proved most effective in increasing feeder efficiency and improving yields. The same results have been achieved with the use of diatomaceous earth, which has been used both as an insulating material and as an exothermic material, the latter purpose being accomplished by mixing exothermic compound with the bonded diatomaceous earth.

Exothermic compounds would be used inside of feeder heads. The preliminary work on this process was completed at the Boston Naval Shipyard.[3] Tests were completed for steel and monel metal, and illustrated use of concentrated exothermic materials indicates that sufficient heat is provided to promote directional solidification. The method used by these investigators was to fill the feeder head with exothermic compound instead of the liquid alloy. This resulted in superheated metal of high fluidity in the heads.

Looking back over the past 10 years, one can appreciate the developments and improvements made in feeding techniques. It appears that the main factor in feeder efficiency is the ability of the metal to flow readily from the feeder head to a portion of the casting. If means of maintaining feeder metal temperatures or applying pressure are provided this ready flow will take place.

### Possible Feeding Methods

Controlled directional solidification is absolutely essential in the manufacture of sound castings. This can be best obtained by careful attention to gating and risering practices. The interdendritic shrinkage of gun bronze and the close shrinkage of manganese bronze have a similar origin—insufficient feeding, which can be corrected by proper control of the temperature gradients within the solidifying casting. Atmospheric pressure operates to the advantage or disadvantage of casting soundness in non-ferrous metals to fully as great an extent as it does in steel, and the principles of operation are identical. Whether good or defective castings result depends upon how well this important foundry tool is understood and applied.

Bonded mixtures of diatomaceous earth are formed into various types of cores, sleeves, hot-top cores, etc.,

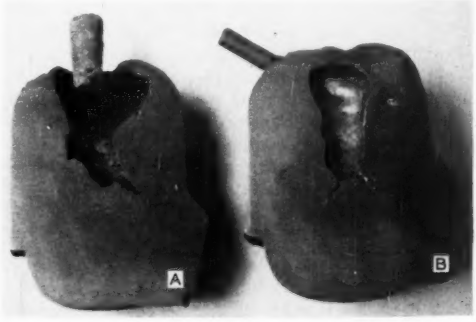



*Fig. 3—Blind risers used on Ni-Cu alloy castings. "A"—diatomaceous earth insert. "B"—graphite rod.*

by ramming, or more properly, by pressing the material in core boxes made for the purpose (Fig. 1). The material has much the same consistency as modeling clay, and when a special shape or contour such as an antichill pad is desired, it can be easily prepared by pressing the material against the pattern, building up to proper thickness, trimming, inserting wires or nails for anchors, and then lifting it off the pattern and drying in an oven. The material has good strength and can be rammed in place against the pattern.

In the same manner it has been used in the foundry to form patterns for chills for irregular surfaces of aluminum castings. After forming the material is dried for 30 to 60 min and given a coating of shellac. The form is then used as a pattern, and metal chills for the job are cast.

Slabs of the baked insulation material are kept in stock and are readily cut on the band saw to required sizes. Air-permeable rods for use in blind risers are extruded through a brass sleeve.

The phenolic resin type binder used imparts strength to the insulating mixture with a minimum amount of binder. Sleeves and collars made with this binder can be used several times on non-ferrous risers.

Sleeves and collars have been made, when phenolic resin was unobtainable, by using bentonite in increased amount as a binder. These proved satisfactory as one-use collars. Materials from all collars, when not fit for further use, are ground to a powder in a pan muller for use in powdered insulating material for ferrous and non-ferrous risers.

Advantages of importance to foundrymen which result from the use of insulating pads and riser sleeves, etc., are as follows:

1. Metal in the riser remains molten until long after the casting has solidified.

2. Use of the insulating pads on thin sections increases the feeding range of the risers.

3. Riser volumes can be reduced as much as 75 per cent in certain cases. Contact between riser and casting can be materially reduced.

Removal of risers and handling are simplified because smaller and fewer risers are required. Also, the contact between riser and casting can be reduced to the point where, with certain metals, the risers may be removed by a hammer blow.

*Fig. 4—Two types of risers used with nickel-copper alloy castings. "A"—Hot-top open riser with knock-off ring core used in combination with insulating sleeve (not shown), both of diatomaceous earth. "B"—blind riser which was entirely encased in diatomaceous insulating cup (not shown), and knock off ring.*

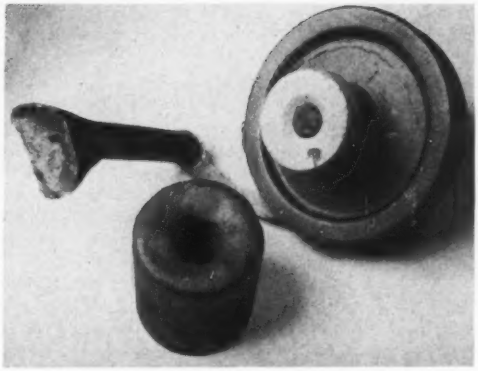


*Fig. 5—Neckdown open riser shown in Fig. 4A used to pour nickel-copper alloy stem disc casting. Riser usually falls off when casting is shaken out of mold.*

Diatomaceous earth insulating materials used with ferrous castings have the advantage over gypsum in that they contain no form of sulphur or chlorine. They do not collect moisture as rapidly as gypsum, and the drying temperature need not be as high.

The analysis of the material is as follows:

| | Per Cent |
|---|---|
| Silica | 84.9 |
| Aluminum Oxide | 6.1 |
| Iron Oxide | 3.8 |
| Calcium Oxide | 3.3 |
| Magnesium Oxide | 1.6 |
| Sodium | trace |
| Boron | trace |
| Titanium | trace |

Molds have been prepared with as high as 30 per cent diatomaceous earth in the mixture and with moisture contents up to 20 per cent, without ill effects on the casting. Under any other condition a 20 per cent moisture content in the mold would result in porous castings. The molding mixture was used with iron as well as non-ferrous castings, with good results.

### Used as "Hot-Top"

Early experimentation with riser insulation at Puget Sound Naval Shipyard was carried out on nickel-copper castings. Figure 2 shows three sectioned test billets of 5-in. diameter cast from the same heat of nickel-copper alloy. Figure 2A shows a billet poured without top insulation. Note cavity in center and depressions in side walls and bottom surface of billet caused by atmospheric pressure attempting to fill the internal void. Early freezing of top of billet, due to radiation of heat from top surface, eliminated directional solidification.

Diatomaceous earth was applied to billet top immediately after metal filled the mold (Fig. 2B). Material was applied to a depth of at least one inch. This billet showed no sinking of external side walls. Directional solidification was promoted by heat reten-

tion in top of billet. Amount of metal cropped to reach solid metal was low for this alloy. No secondary shrinkage is apparent.

As exothermic riser-covering material was applied to the billet shown in Fig. 2C. Shrink depression is deeper than on billet B, and secondary shrinkage below the pipe increases the amount to be discarded to reach solid metal. Pipe cavity is narrower and deeper than in billet B, showing that solidification from top side walls progressed more rapidly, indicating that heat added by exothermic reaction actually was less than the heat retained by insulation in billet B.

Figure 3A shows the application of a diatomaceous earth insert to blind risers on nickel-copper castings. This alloy is prone to form a solid cap of chilled metal over the tops of blind risers. The purpose of the insert is to insure easy passage of atmospheric pressure to heart of blind riser. Figure 3B shows a blind riser with a graphite rod, as previously used. Note the heavy cap formed over top of riser. The diatomaceous earth insert provides better entrance of atmospheric pressure even when the cap of the riser is solid (as it often is due to peculiarities in the feeding system), and extracts less heat than graphite or core inserts.

Figure 4A illustrates an open riser with a knock-off ring core of diatomaceous earth in combination with insulating sleeve (not shown) of the same material. This riser is always covered with powdered diatomaceous earth and has proved very efficient in feeding heavy sections such as hubs of gears or heavy gate discs (Fig. 5). It works well wherever a top riser is needed for a maximum amount of feeding.

### Insulating Top Risers

An entire blind riser (Fig. 4B) is encased in an insulating cup. This type is especially effective on jobs fed by side risers. The cup used on this type of riser can be used several times because of ease of removal from the dome-shaped riser. This riser cup with knock-off ring facilitates the blinding of top risers.

Figure 5 illustrates the use of riser shown in Fig. 4A. This riser usually falls off at shakeout. Grinding off the short neck completes the job. Metal lays against the insulating material satisfactorily. This same type of riser is used on corrosion-resisting steel with equally good results.

A 9-ft casting (cope side) with insulating collars intact on risers is shown in Fig. 6. This casting is made in aluminum-manganese bronze, class b, Spec. 46-B-29a (15 Dec., 1945). High feeding demands of this metal warranted ample risering to insure perfectly solid metal in the casting, a turret guide rail in which several rows of gear teeth were to be machined.

Five risers, 5 in. in diameter by 7 in. in height and evenly spaced along the casting length were encased in diatomaceous earth collars which had been baked previous to ramming in the mold. The top of each riser was covered with diatomaceous earth powder which had been heated in the core oven to a temperature of 450 F. Fire brick was placed on top of the powder. Feeding by churning or addition of hot metal was not attempted. It was assumed that preheating the powder would help conserve heat in the riser.

*Fig. 6—Aluminum-manganese bronze casting with five risers evenly spaced along 9-ft length. Diatomaceous earth insulating collars are shown intact on each riser. Risers were topped with preheated diatomaceous earth insulating powder and covered with fire brick.*

Risers showed good feeding and the casting was perfectly solid. On the first trial the pouring weight was 1075 lb and the cleaned casting weighed 575 lb. In subsequent trials riser heights were progressively reduced from 12 in. to 5 in., a saving of 225 lb of metal. Metal in sprues and runner system, employed to give dross-free metal, weighed 190 lb. Risers 5 in. in height and weighing 17 lb each produced sound castings, but showed beginning of secondary shrinkage where the riser was necked down slightly at the base. Secondary shrinkage was confined to the riser exterior.

Experience has shown that risers on heavy castings of aluminum-manganese bronze give maximum feeding if the riser is carried full size down to the casting, with an insulating collar extending to within one inch of the top of the casting. An alternative method used was a thin hot-top neck core, such as used for knock-off risers on steel castings, on top which was placed an insulating collar.

Castings made from this pattern without insulating collars on risers (insulating powder on tops only) showed secondary shrinkage extending from the base of the riser into the casting, occurring in scattered areas throughout the castings, although risers in this instance were twice the height of the insulated risers.

A pattern board assembly and cast aluminum-manganese bronze billets are shown in Fig. 7. A small paper

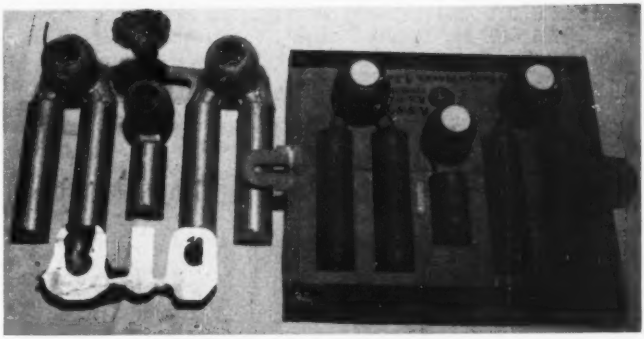


*Fig. 7—Pattern board assembly used to mold aluminum-bronze solid billets shown with risers and gating system attached, and sectioned risers and gate showing shrink cavities. In the blind riser at the left a small paper cup filled with powdered diatomaceous earth was rammed up. In the riser at the right a baked core of the same material was inserted. Much greater pressure was obtained in the riser at the left in which the paper cup of powdered diatomaceous earth was used.*

cup filled with powdered diatomaceous earth was rammed in the blind riser at the left. In the other riser a baked core of the same material was inserted. The shrink cavities in the sectioned risers show that much greater pressure was exerted in the left riser in which the paper cup of powdered material was used.

An early application of diatomaceous earth insulating materials in feeding high test cast iron is shown in Fig. 8. The upper pump casing (Fig. 8A) was fed with one riser and required 1875 lb of metal. The cleaned casting weighed 1700 lb.

In the absence of a proper size insulating collar, segments of insulating slab were rammed up around the riser down close to the neck between casting and riser, thus insulating the sides of the riser. Pouring continued until the metal reached the riser neck. The ladle then was brought over the riser to fill it with the hottest metal. The top of the riser was well covered with insulating powder and then covered over with a plate. The riser was not churned although powdered insulation was stirred in top of riser to heat the material thoroughly, and more powder was added. The riser showed evidence of considerable feeding.

Figure 8B shows a lower pump casing casting (upper casing shown in Fig. 8A). Three heavy insulated risers were used over heavy sections of the casting. Insulating powder was used as covering over all risers. Poured weight, 3825 lb Cleaned weight, 3065 lb.

Later trials with the feeding of aluminum castings were made with a solid billet 12¼ in. in diameter by 15 in. long cast of class 5 aluminum, Specification 46A1. A 12-in. length was cut off the drag end of the billet, and from this an ordnance magazine was machined. This casting was solid and free from shrinkage defects. The top 3 in. of the billet, weighing about 40 lb, served as a riser for the casting. This riser section was insulated on its circumference with slabs of plastic-bonded diatomaceous earth ¼-in. thick, forming a

*Fig. 8—Upper and lower sections of pump casing poured in high test cast iron. Insulating slabs were used on riser sides, and powdered material on riser tops. "A"—Upper pump casing—poured weight, 1875 lb; cleaned weight, 1700 lb. "B"—Lower pump casing—poured weight, 3825 lb; cleaned weight, 3065 lb.*

band 3 in. wide around the billet. The top of the riser was covered with 2½ in. of powdered diatomaceous earth which had been preheated to 450 F. An insulating slab was then placed over the powder.

The billet settled down evenly and the top was only slightly concave. Close inspection of the top of the riser showed an outline of crystalline dendrites and indicates that no chilled skin formed over the surface, but rather that the top metal was the last to solidify, supplying ample feed metal to portions solidifying progressively from bottom to top.

*Fig. 9—Propellor blade (11,300 lb cleaned weight) cast of Composition "MN" metal, Specification 49B3f of Mar. 1, 1945. Lower parts of risers were insulated with diatomaceous earth sleeves, and 6 in. of powdered earth insulating material was used on riser tops.*

Appearance of the longitudinal section of the billet showed that the usable portion extended to the immediate vicinity of the upper surface. The billet was poured with a gating system which brought the metal to a height of 11 in. with absolutely no turbulence, and the top 4 in. was filled from a pouring basin on top of the mold, also without turbulence or dross formation. The pouring temperature was 1270 F.

A propeller blade casting of "MN" metal (cleaned weight, 11,300 lb) is shown in Fig. 9. This casting was risered with one 7x30-in. and one 12x25-in. riser on the blade, and one 8x15-in. riser on the hub. The lower parts of the risers were insulated, and after pouring approximately 6 in. of powdered diatomaceous earth was placed on riser tops. Forty minutes after pouring an additional 300 lb of metal was poured into the largest riser, the metal feeding through to the two smaller risers. Neither churning nor hand feeding was used in this riser. The sectioned risers showed secondary shrinkage adjacent to the casting but the casting under the risers was sound.

In general, the tendency in the foundry is to increase yields by reducing riser sizes. Many of the methods employ exothermic materials which generate heat when added to the molten metal in the risers. The writer believes that reduction of riser costs and more efficient feeding of castings can be effected through controlled directional solidification, and that one of the most economical ways to accomplish this is through heat retention in the proper places.

The author wishes to express appreciation to the Navy Department for supplying all illustrations used in the paper.

### References

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2. S. L. Finch, "Feeding Castings," AMERICAN FOUNDRYMAN, Oct., 1947, p. 51.
3. C. G. Lutts, J. P. Hickey, and Michael Bock II, "Exothermic Materials," AMERICAN FOUNDRYMAN, Aug., 1946, p. 71.
4. Paul von Colditz, "Increasing Casting Yields," AMERICAN FOUNDRYMAN, Oct., 1948, p. 48.
5. S. T. Jazwinski, "Feeding Castings—A New Approach," AMERICAN FOUNDRYMAN, May, 1948, p. 75.

## Refractories Research Progress Reported In ARI Annual Bulletin

TECHNOLOGY WILL ALWAYS BE AN IMPORTANT FACTOR in the development, manufacture, and use of refractories because of the basic nature of the product to almost every industry, according to the annual report on the Refractories Fellowship for the year 1947-48.

Sponsored by the American Refractories Institute at Mellon Institute, the fellowship provides testing and research service to producer and consumer members of ARI. During the year covered by the report, Bulletin No. 85, considerable attention was given to the spalling test particularly to the mortar used and to automatic features.

Most satisfactory technique to date involves thinly coating the test brick with pure alumina and then laying them with regular kaolin mortar. This minimizes use of costly alumina and reduces adherence of kaolin to test brick with resultant spurious test results due to difficulty in removing the mortar from the brick.

Tests comparing laying of brick in the test panel as headers and as stretchers indicates that when headers are laid in a furnace wall more spalling may be expected. A detailed account to be published by ARI soon will show that the fewer the joints and corners, the less tendency toward spalling.

Volume determinations of refractories have never been wholly satisfactory, chiefly due to large errors inherent in the test method. A water displacement method in which the specimen is coated with a thin water-repellent silicone film shows promise.

During firing, refractory wares should be allowed to expand or contract at a relatively uniform rate. To enable manufacturers to adjust their heating schedules to provide uniform volume changes, the fellowship developed high-temperature thermal expansion equipment some years ago. The equipment continued to serve the refractories industry well during the past year.

# INTERNATIONAL CAST IRON SPECIFICATIONS

**A questionnaire, designed to secure reports of the newest standards and specifications effected in various producing countries, was compiled at a meeting of the International Committee on Testing Cast Iron in Liège, Belgium, in 1947. The five questions are listed immediately following.**

### QUESTIONS

**I.** List of new and revised standards issued since 1939.

**II.** State briefly the most important provisions of each of these specifications.

**III.** Give a brief summary of the most important changes which will result from each of these new and revised specifications.

**IV.** What are the present trends, and what important developments and changes are likely to take place in the near future?

**V.** Do the specifications in your country specify methods of casting test bars? If so, please state which.

**In the following tabulation of replies received from the various countries, the corresponding question number is shown at the head of each answer.**

### GREAT BRITAIN

(Summary of report presented Sept., 1947.)

**I**

(a) 786—1938 High Duty Iron Castings amendment in 1941.

(b) 1349—1947 Impact Testing. 309 and 310 Whiteheart and Blackheart Malleable. Revised spec. 1948.

(c) The most important feature of this specification is that it supersedes the two specifications—No. 321 Gray Iron Castings and No. 786 High Duty Iron Castings and applies a completely new nomenclature to the various grades.

**II**

(a) Increased mechanical testing requirements.

(b) Bend alternative to certified phosphorus content. In Whiteheart, size of test piece varies with wall thickness. Two grades. In Blackheart, one size bar but three grades.

(c) Specifications 321 and 786 combined.

**III**

(a) Replacement of steel by iron castings.

**V**

No, but Institute of British Foundrymen have recommended methods of casting test bars.

### FRANCE

**I**

Malleable Castings (French standard specification A 32-811)—This standard specification has been approved by AFNOR (The French Standards Institute) in Jan. 1948. It is a new document.

Gray Iron Castings (Proposed standard specification A 32-101)—This document is only a proposal and will very soon be put up for approval (by AFNOR). Its object is to substitute a standard specification for the various technical specifications now existing in France, and which are put out by the leading administrative bodies (Railroads, Armament, Navy, etc.).

**II**

Malleable Castings—Two grades of Whiteheart malleable are proposed, these being characterized by their tensile strength and their elongation; the proposed grades are identified by numbers 35-5 and 35-10, which both have 35 kgs (per square kilometre) tensile strength and minimum elongations of 5 per cent to 10 per cent respectively. In regard to Blackheart malleable, four grades are proposed: 35-5, 35-10, 38-15 and 38-18.

Gray Iron Castings—Up till now only small test pieces were used in France, which enabled more especially the measurement of shearing tests and Frémont static bending to be obtained. In the new proposed specification it is proposed to make use of large test pieces very similar to those used in the United States, Great Britain and U.S.S.R.

**III**

The more important changes which characterize new documents refer to coal.

For malleable castings, the introduction in French standards of metal of a grade giving a greater elongation (15 per cent and 18 per cent for Blackheart malleable).

For gray iron castings, the adoption of large test pieces and use of tensile tests.

**IV**

In regard to new specifications which are anticipated in the near future, it is likely that these will bring about the adoption of grades of metal for castings having high mechanical characteristics with particular reference to heat-resisting and corrosion-resisting qualifications.

For malleable castings, the test pieces used are "as cast." For gray iron castings the test pieces are machined with a threaded head and are similar to American test pieces; they are taken from samples poured in molds according to the standard specification.

### POLAND

**I**

PN/H—751. Classification of Gray Iron (New).

PN/H—752. Testing of Gray Iron (New).

PN/H—06051. Pipes for water and gas and castings for use therewith (Revised).

PN/H—74051. Pipes for water and gas and castings for use therewith (Revised).

**II**

Application of cast iron test bars, 20, 30 and 45 mm diameter.

**III**

No important changes.

**IV**

No important changes.

**V**

Standard PN/4572 specifies method of casting and testing test bars.

### HOLLAND

**I**

(a) V 1680, V 1681 Bicycle accessories. Malleable Cast Iron. 1947 new.

(b) N 438 (1940) and V 897 (1942) Electric Installation accessories. Ordinary gray iron. New. (Presumably switch and fuse boxes etc.)

(c) N 772 (1939), N 908 (1941), N 1315t, N 1316, N 1427, N 1428, N 1429, N 1430, N 1431, N 1432, N 1433, N 1434, N 1435, N 1436, N 1437, N 1522.

Pipe lines for water and gas mains. Ordinary gray iron. N 772 and N 908 temporary. All others new.

V 1575 (1945), V 1576 (1945), N 1483 (1946). Ships' requirements. Material, gray iron, 14 kg/mm².

V 1553. Malleable cast iron for ships' requirements. 1945. New.

(d) N 1247. Machine parts. Pulleys and V-belt sheaves. 14 kg/mm² material. New 1941.

(e) V 1031 (1) General mechanical tests. 1941 New.

(f) V 1033 (1) Pig iron, cast iron, cast steel, analytical testing. To substitute N 714. 1941.

(g) V 1035(1). Iron and Steel. Administrative regulations and inspection.

(h) V 1035(2). Pig iron, cast iron (gray, white, malleable, chilled), cast steel, ingots, semi-fabricated products.

**II**

(a) Shape-dimensions.

(b) Shape-dimensions.

(c) 909. Inspection requirements. All others, shape-dimensions.

(d) Shape-dimensions.

(e) Standardizing, tensile, transverse, hardness, notched bar impact tests.

(f) Determination of Si, Mn, P, S, C, Cu, As, Ni, Cr contents.

(g) Inspection of shape, dimensions, weight. Chemical and mechanical testing.

(h) Definitions, inspection requirements, chemical and mechanical testing (casting of test bars), 1943. To substitute N 709, 710, 711, 715, 716.

**IV**

Standardizing of products, more extensive requirements.

**V**

(a) Cast separately. In this case two test bars are cast in one dried and blacked mold in such a way that they are representative of the cast material. Bars are removed from the mold only after cooling to room temperature.

(b) Cast attached to the castings; diameter according to the controlling section of the casting.

(c) Cut out of the casting.

### UNITED STATES

**I**

See A.S.T.M. Standards 1946 Part 1A.

A 48-46 Gray Iron Castings.

A 126-42 Gray Iron Castings for Valves, Flanges and Pipe Fittings.

RS A 190-44T Gray Iron Castings Light weight and Thin Sectioned.

RS A 159-44T Gray Iron Castings Automotive.

CT A 278-44T Gray Iron Castings for Pressure, Containing Parts for Temperatures up to 650° F.

RS A 196-46T Definitions of Terms Relating to Cast Iron.

RS A 247-41T Recommended Practice for Evaluating Microstructure of Cast Iron.

RS A 42T Torsion Tests of Cast Iron.

**II**

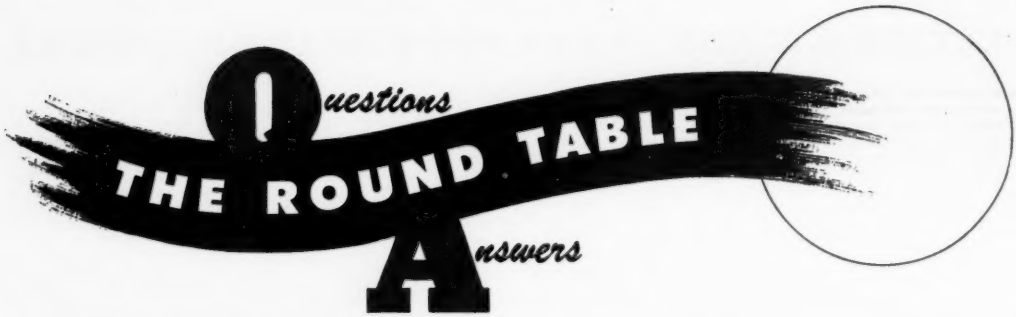
The most significant trends in Standards were the adoption A247-41T Evaluation of Microstructure and the consideration of cast iron for higher pressures and temperatures, as for pressure parts up to 650°F. Sub-committee XXII on Elevated Temperature Properties of Cast Iron is studying a standard for cast irons for high-temperature service.

**IV**

Engineers are beginning to use cast iron with lower safety factors, so better information regarding mechanical properties in a given portion of a casting is required. Acceptance of 1.2-in. bar as a general standard is diminishing. Trepanning test bars is practiced by some firms. Microstructure is receiving increasing attention.

**V**

Test bar design is receiving attention.




## Will Not Answer Blind Questions

**Please advise whether you can give us information on manufacture of cast iron molds used for permanent mold castings production.**

We have on several previous occasions expressed to you our willingness to supply information if we have it available, and have pointed out that under no circumstances will we supply such data unless the name and address of the inquirer are given so we can make the reply directly.

If you will supply such information we will be glad to cooperate, but unless such an arrangement is acceptable to you and you consistently adhere to it, we must deny you any data which we may have.

## Plans Foundry Training Program

**We should like the names and addresses of trade schools or colleges offering courses in foundry practice. We are interested in extension courses and therefore in schools in this area.**

For a school in your immediate locality, communicate with J. L. Gross, coordinator of foundry practice, Murrell Dobbins Vocational-Technical school, Philadelphia. Two correspondence schools which provide instruction in foundry practice are: International Correspondence Schools, Scranton, Pa., and American Technical Society, 850 E. 58th St., Chicago, Ill.

## Cupola Stack Emission Control

**A local ordinance has been proposed which would limit the emission of smoke, soot, cinders, noxious acids, fumes, gases, and fly ash from chimneys and stacks. Have you any information indicating what quantity of fly ash normally comes from a cupola? We are considering installation of dust and smoke removal equipment on new 78 in. stacks.**

There is an increasing tendency throughout the United States to control dust and smoke emission. In Los Angeles it is prohibited to discharge more than 0.40 grains per cubic foot of particulate matter (measured at the point of discharge) into the atmosphere. Special restrictions are placed on specific contaminants such as lead, zinc oxide and sulphur compounds. Utica, N. Y., has proposed an ordinance requiring the use of emission control equipment which will limit the quantity of fly ash to 0.75 grains per cubic foot of flue gas at a stack temperature of 500 F. Not more than 0.2 grains per cubic foot may be large enough to be retained on a 325 mesh U.S. Standard sieve.

The quantity of fly ash coming from a cupola varies considerably with size, construction and method of operation. One observer operating a gas washing device mounted at the top of the cupola stack recovered up to 10 lb of solids per ton of metal melted. A Los Angeles survey showed that cupolas there released 0.798 to 1.604 grains per cubic foot.

One of the most simple and least expensive devices consists of a conical shield in the stack. Immediately below is an annular trough which collects the water spray introduced above the cone. Gases are cooled and particulate matter removed by passing through the sheet of water running off the cone and through the water spray above it. Water in the trough runs into a sump where the solids collect at the bottom and are removed periodically. The clear water is re-circulated by means of a pump and discharged above the cone.

Another type of dust collector is the wet cyclone type in which large quantities of fume and solids are trapped through a combination of decreased gas velocity and a water spray.

The manufacturers of the several types of dust and fume control devices will be glad to furnish you with cost and performance data for their equipment.

## Steam For Cupola Blast Preheating?

**We should like to obtain information on the preheating of blast for cupolas. Is preheating by means of steam generated in a boiler practical?**

Most of the cupolas using preheated blast withdraw a portion of the effluent gases at the charging door, burn them in a combustion chamber and circulate the hot gases around a series of iron tubes through which the blast is passing. The method saves fuel and adds to the uniformity of melting. However, the original cost and maintenance cost are relatively high and the method is not economical unless the cupola is operated at least six to eight hours continuously.

Blast preheating equipment using an externally-fired heat exchanger is becoming more popular. The original cost of such equipment is less than the type first described and its operation is not dependent on attaining equilibrium within the cupola so that sufficient quantities of combustible gases are available for heating the blast preheater. Maintenance of this equipment is generally less and units can be installed on much smaller cupolas and still show economic advantage.

A heat exchanger using steam generated in a separate boiler does not offer much promise since pre-

heated blast temperatures are normally around 300 to 350 F. Such temperatures would involve the use of superheated steam and it seems likely that a direct fired, external type heat exchanger would be more efficient and less costly.

Blast preheating is described in *"Cupola Operation with Heated Blast,"* AMERICAN FOUNDRYMAN, March 1948, page 44. First in a series sponsored by the Cupola Research Committee, this article was followed by others in April, May, October and December. The series will continue in 1949.

## Other Metals Cause Corrosion

**We have an unusual case of deterioration of cast iron in the water jacket of an air compressor which has been in service nearly 15 years. Around the water port, the machined surface shows a black border in which the iron has become soft. With an ordinary knife we can easily whittle the black material and the shavings resemble those from a lead pencil. The analysis of the cooling water indicates no special corrosive influences; the water is very slightly alkaline.**

The localized corrosion you describe leads us to suspect that there was a brass ring or other brass part in immediate contact with the casting at this point. This type of corrosion frequently occurs in gray cast iron in contact with alloyed steel or one of the non-ferrous metals. We have seen this occur where brass valves caused very rapid deterioration of cast iron valves carrying clean sea water. The substitution of iron valves seems to have stopped the corrosion entirely.

## Need Standard Coke Specification

**Can you furnish us with an accepted standard coke specification?**

The large purchasers of foundry coke have their own specifications which vary to satisfy their own ideas and requirements. Similarly, the Government and some of its branches have foundry coke specifications. These can be obtained by writing to the U. S. Bureau of Mines or to the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

Jointly, the American Society for Testing Materials and the American Foundrymen's Society developed specification D17-16 which was discontinued in June, 1941, leaving no standard specification. Specification D17-16 provided for: moisture, 3.0 per cent max.; volatile matter, 2.0 max.; fixed carbon, 86.0 min.; ash, 12.0 max.; and sulphur, 1.0 max. The coke specification of a large automotive foundry includes: volatile matter, 2.0 max.; fixed carbon, 90.0 min.; ash, 8.0 max.; and sulphur, 0.65 max.

For most purposes, coke purchased to either of these specifications will prove acceptable provided it meets them consistently and its physical characteristics insure uniform behavior in your cupola. Coke too fine or too coarse, or coke that is weak and friable, will not perform well. The physical structure and density of the coke also affect the rate of burning and the carbon absorption by the metal.

## See Trade Associations on Pricing

**Can you send us a treatise or paper on the subject of pricing various jobs for standard practice molding operations on the piece-work or incentive plan? We operate a malleable jobbing foundry.**

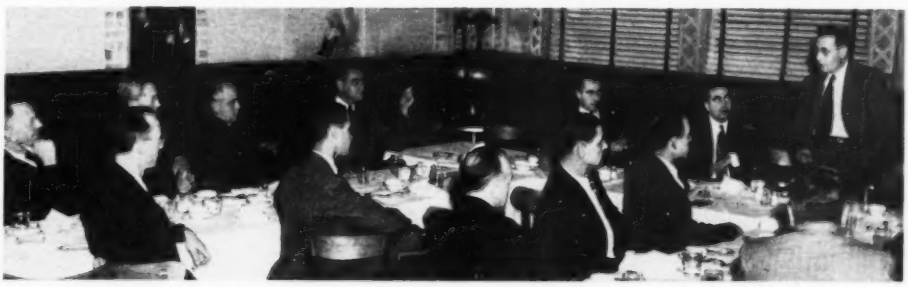
As a technical organization, American Foundrymen's Society does not enter the field of pricing and we therefore are unable to provide the information you request. We suggest you consult either the Malleable Founders' Society, Union Commerce Bldg., Cleveland 14, Ohio, or the National Founders Association, 120 S. La Salle St., Chicago 3, Ill.

## Getting Tin Without Allocation

**Will you please give us information on wholesale purchasing of block tin?**

Block tin is under government allocation, and to purchase more than two tons per month it is necessary to file a request with: Department of Commerce, Office of Domestic Commerce, Non-ferrous and Minerals Division, Washington, 25, D. C. Quantities less than two tons per month can be obtained from any of the regular suppliers of non-ferrous metals merely by stating the intended use on your order.

## NATIONAL FOUNDERS HOLD REGIONAL MEET



*Charles Wesson, Sargent & Co., chairman of the National Founders Association's First District (standing) addresses an NFA Regional Meeting, held December 1 in New Haven, Conn., and attended by 25 members. Other speakers were Franklin Farrel, 3rd, NFA president (at Mr. Wesson's right) and L. E. Roark, NFA executive vice president (not shown in this photograph).*

# SPECIAL TECHNIQUES REDUCE COMPOSITE CASTING LOSSES

**Arthur K. Higgins**
**Chemistry & Metallurgy Supt.**
**Allis-Chalmers Mfg. Co.**
**Milwaukee**

**Normal casting loss percentages become prohibitive in composite casting production because of the high value of the inserts. When fundamental principles of composite casting processes are understood, it is possible to keep foundry scrap below 0.2 per cent over long periods. This paper, reprinted from the November 1948 issue of *Metal Progress*, describes control methods used in the production of sound composite castings.**

At some time in its history, every progressive foundry is faced with a type of casting, outside of normal foundry technique, but so attractive for any of a number of reasons that development of unusual production methods seems reasonable. A not uncommon item of this type is a casting having prefabricated inserts included in its structure, either for strengthening vital portions, or for giving specialized properties to limited surface areas. It is true that the foundry is daily faced with a similar problem in its normal use of chaplets and internal chills—and, although these ordinary requirements are seldom severe, the scrap losses due to failure of the chaplets to bond may be disturbingly high.

Examples of the foregoing techniques have been developed by some foundries for "casting in" cooling or heating coils into process equipment parts; for surrounding soft hubs with more wear resistant disks; providing better wearing surfaces on brake drums; bonding of bearing materials to shells of higher strength, and placing vanes and buckets of high alloy in wheels or rings of ordinary steels. In almost all of these applications it is found that careful preparation and precise control are essential if the operation is to be economically sound.

### Service Loads Are Severe

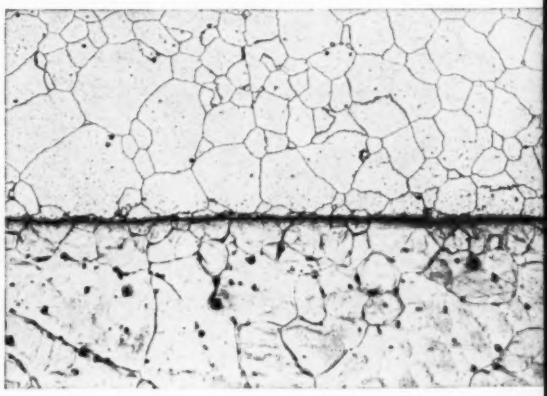
Among problems of this type, few receive more critical inspection than that of casting an alloy base around a group of prefabricated inserts that must bear tensile and fatigue loads. Requirements of this type of casting are extremely severe, since the junction between insert and base must be strong enough to equal the tensile strength of the insert itself, while at the same time the insert must not be adversely affected by the manufacturing process.

A few small gas holes along the junction between insert and casting may be tolerated, but in no case may a part of the insert be melted or washed away. The necessary strong bonds between insert and casting will result only if the major portion of the insert's surface is thoroughly fused and alloyed with the base or surrounding metal.

In the study of a problem of this type, the metallurgist will first deduce the requirements for the materials used. He will not consider the obvious need for adequate strength and resistance to corrosion, under conditions of normal operation, since these needs are met by ordinary judgment of the engineers responsible for the design. The special requirements of metallurgical properties must, however, be considered in detail.

First, of course, the metal being cast must have a suitable melting point. It must not have a higher melting point than the insert used, for obvious reasons. It may have about the same melting point as the insert if the latter is of large cross section, but it is preferable that it be substantially lower than the melting point of the insert.

Second, the material being cast must not form tenacious surface films since such films tend to fold around the surfaces with which they come in contact, and prevent bonding. Typical examples of this type of film-forming alloys are those containing aluminum (such as the aluminum and manganese bronzes) and copper-base alloys that contain chromium. When either aluminum or chromium is present in the molten



alloy, even in small amounts, the resulting bond with solid metallic inserts must be viewed with suspicion.

A third requirement of equal importance in highly stressed castings is that the cast metal must retain, as a residual, some gas-absorbing constituent, since some gases are inevitably absorbed and combined on the surface of the insert. Phosphorus and silicon are fairly effective in this respect while magnesium and calcium —with their high affinities for most of the common gases—are particularly good.

The fourth requirement is that the casting metal must not form brittle intermetallic compounds with the material of which the insert is made. If it does, mechanical failure of the bond will occur when the insert reaches its elastic limit, or has elongated sufficiently to exceed the shear strength of any portion of the bond. As soon as shear has begun, it will continue until complete failure results.

Undesirable combinations of insert and casting might be such pairs as tin-base or zinc-base alloys cast against copper-base inserts, high-phosphorus alloys cast to any of the steels, or high-aluminum alloys against copper-alloy insert. Fortunately, the only one of these combinations that is likely to be considered is that of high-phosphorus alloys against steel. Good combinations are represented by the copper-base alloys with copper-nickel inserts, and some of the copper-nickel alloys with almost any of the steels.

Where a satisfactory choice of metal pairs has been made and when optimum technique is used, a true alloying action can be expected, in the sense that the grain structure of the insert will determine the orientation of the surface layers of cast metal, and grain boundaries will continue across the casting-insert interface. Examples of satisfactory and unsatisfactory bonds are shown in the photomicrographs of Figs. 1 and 2.

The material of which the insert is to be made is primarily dictated by design considerations and by the corrosion resistance required—and, in turn, serves to influence the choice of base material. Having selected the materials for insert and for casting, the next step is the preparation of the inserts for the casting operation.

Normal requirements are that the insert surfaces must be free from dirt, rust, or scale, and must not have heavy oxide or other chemical films that may react with the base material being cast around them. Actually, the attainment of these conditions is not easy. If the insert is a common steel, it will be somewhat scaled (if heat treated), and at the very least will have its surface contaminated with oil, dirt and finger marks from handling and manufacturing operations.

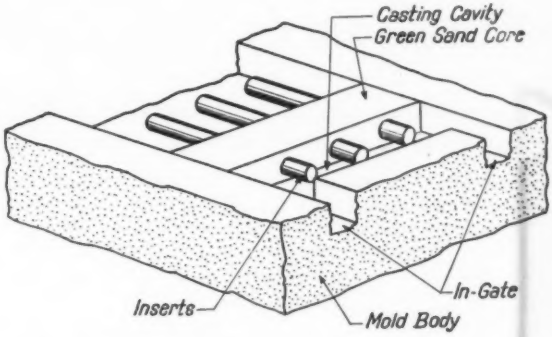



*Fig. 3—Proper molding method for a composite casting.*

After a degreasing operation, steel surfaces should be carefully inspected for scale, particularly the rolled-in scale that may result from skin-working passes on rolled bars or sheets that were not adequately pickled after the previous anneal. Usually a special etching technique must be developed to detect defects of this type. All scaled pieces should be discarded.

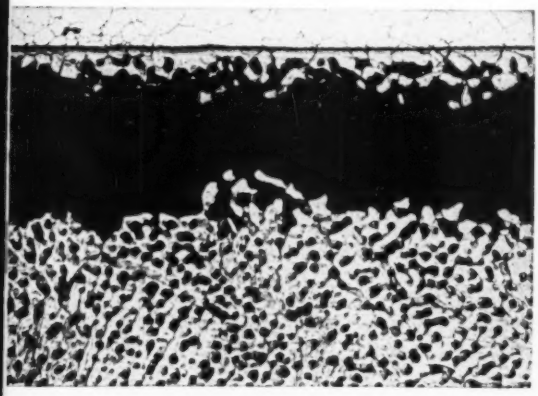
Following such inspection, the insert must be *vigorously* cleaned. Suitable methods are by electrolytic etching with the work as anode, by vapor blasting, or by any other similar process. If the material is resistant to rusting and atmosphere oxidation, it may be cast-in without further treatment.

When it becomes necessary to protect the insert from rusting or oxidation, it is most satisfactory to plate the carefully cleaned surface with a noble metal. Silver has been used satisfactorily. Other materials such as tin and nickel might well be suitable, but care must be taken to avoid metals such as chromium (which because of its high modulus of elasticity, reduces the fatigue life of the insert). The volatile metals, zinc and cadmium, seem unsuitable because of their tendency to form gas holes during casting.

For some applications—notably when casting steel inserts into gray iron—thin phosphate coatings seem suitable for the steel inserts. Other chemical protections, such as dipping in sodium chromate solutions, are not satisfactory because the coatings break down at casting temperatures and liberate excessive gas.

Proper foundry procedures for making castings of this type are the most difficult to set up. Scrap must

*Figs. 1 and 2 — Photomicrographs showing satisfactory (opposite page) and unsatisfactory (below) bond between insert and casting. Note numerous small gas holes in casting and wide gap at interface in the unsatisfactory bond shown below. Inserts are at top and castings below in both photomicrographs. 100X.*



be kept to a minimum because the value of the group of inserts included in a single casting may far exceed the cost of the cast metal and the making of the mold. It therefore becomes economical to apply foundry control that goes beyond normal practice.

Since the sizes of composite castings may vary from a few ounces to several hundred pounds, no single mold design is suitable for all. We can, however, lay out certain principles of operation common to all.

Because the surfaces of the inserts must be scrupulously clean, the use of baked cores around the inserts is prohibited since they deposit films of varnish and oven smut on the inserts—unless the units are so large that the inserts may be be cleaned by hand after the cores are baked. All the smaller assemblies, which make up the greatest bulk of the work, must be rammed up in green sand cores, using clay binders rather than organics.

Since the area of the core between the inserts is usually small, the green sand cores should be allowed to air-dry to some extent, so that less steam will be formed when molten metal enters. If a very wet sand is used, heat from the casting face added to the heat carried back along the inserts will generate steam at a greater rate than can be accommodated by the sand's porosities, and "core blows" will result. The mold itself may be made of either green or dry sand, since it is made before the core carrying the inserts is put in place. Such necessary conditions are sketched in Fig. 3.

### Gating the Mold

Gating of the mold is extremely critical. Experience has shown that certain conditions apply: First, large amounts of metal must not flow past any insert, since —regardless of the melting temperature of the insert, as long as it is above the melting point of the cast metal—the liquid metal exerts a solvent action on the insert in much the same fashion that the warm saliva of a cow's tongue eventually dissolves a cake of salt.

Second, the cast metal must reach the surface of the insert with enough residual heat to remelt the chilled layer that forms at first contact with the cold surface. If this condition does not obtain, inevitable traces of gas absorbed or formed on the surface of the insert cannot be absorbed by the still liquid metal, and bubbles will be formed along the surface of the insert, destroying the bond between it and the cast metal.

If these two conditions are to be insured, the metal must enter the mold cavity at a point very near its final position. This is not an easy condition to attain; however—two general considerations apply: if the casting is short, it may be gated from both ends, with the gates so oriented that the entering metal does not impinge on any of the inserts; if the casting is long or contains a large volume of metal, a fin gate of the type commonly used on test bars may be effective. It, too, should be placed to avoid directing the entering stream against any insert.

With the foregoing gating principles in mind, it is possible to design a mold that will yield satisfactory results. Elimination of unsoundness due to shrinkage, and other casting difficulties are not peculiar to the problem at hand.

### Careful Melting Required

The preparation of the melt for casting follows usual foundry practice except that extreme care must be used to secure uniformity. Cleaned return-gates, as well as new metal used in the charge, should be weighed to allow precise control of deoxidation, since the success of the process depends to a large extent on the retention of trace amounts of the active deoxidizer in the melt at the time of pouring.

If the melting is done under an open flame, control of furnace atmosphere must be good and, where possible, proportioning-type burner equipment with fre-

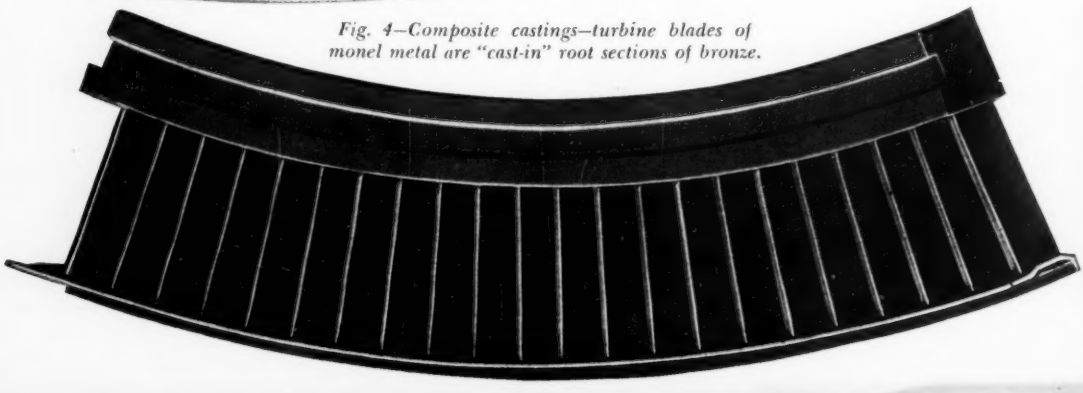


*Fig. 4—Composite castings—turbine blades of monel metal are "cast-in" root sections of bronze.*

quent analysis of the combustion products seems best—although excellent results have been obtained with less precise equipment.

Time of addition of the deoxidizing material should also be controlled within narrow limits, preferably by clock, since losses vary as a function of time.

The final variable, pouring temperature, can nullify all of the preceding cautions if it is not properly controlled. Too high a pouring temperature will obviously melt the inserts. Too low a temperature will result in lack of bond, entrapped gas, and cold-shuts between the inserts.

Proper temperatures will normally fall within a 50 to 70 F range. Since the desirable temperature depends on the gate as well as the metal, consistent gating practice is imperative.

The usual practice is to bring the pouring ladle to the floor with an excess temperature of 50 to 100 F. The temperature is carefully followed with a pyrometer suited to the material, until the upper pouring limit is reached. Pouring is then started at once and continues until the pyrometer indicates that the lower pouring limit has been reached. After this limit has been reached, no more castings are poured, even if half of the metal remains in the ladle.

This description of the variables and controls involved may seem to indicate an almost impossible control system. Fortunately, this is not true. It has been possible to operate for long periods of time with foundry scrap below 0.2 per cent, and with single months below 0.1 per cent. This is far below normal scrap expectation in general foundry work, and indicates the possibilities where fundamental principles are understood.

### Future Meetings and Exhibits

BIRMINGHAM REGIONAL FOUNDRY CONFERENCE, A.F.S. Birmingham District Chapter, Birmingham, Ala.—Feb. 17-19.

MALLEABLE FOUNDERS' SOCIETY, western sectional meeting, Palmer House, Chicago—Feb. 25.

AMERICAN SOCIETY FOR TESTING MATERIALS, spring meeting and committee work, Edgewater Beach Hotel, Chicago—Feb. 28-Mar. 4.

MALLEABLE FOUNDERS' SOCIETY, eastern sectional meetirg, New York—Mar. 4.

AMERICAN SOCIETY OF TOOL ENGINEERS, 17th annual meeting, Hotel William Penn, Pittsburgh,—March 10-12.

OHIO REGIONAL FOUNDRY CONFERENCE, A.F.S. Ohio Chapters, Ohio State University, Columbus—Mar. 11-12.

CHICAGO TECHNICAL SOCIETIES COUNCIL, conference and production show, Stevens Hotel, Chicago—March 14-17.

MALLEABLE FOUNDERS' SOCIETY, western sectional meeting, Palmer House, Chicago—Mar. 25.

ANNUAL SAFETY CONVENTION AND EXPOSITION, Hotel Pennsylvania, New York—Mar. 29-April 1.

NATIONAL ASSOCIATION OF CORROSION ENGINEERS, annual conference and exhibition, Cincinnati—April 11-14.

AMERICAN SOCIETY FOR METALS, Sixth Western Metal Congress and Western Metal Exposition, Shrine Auditorium, Los Angeles—April 11-15.

MAGNESIUM ASSOCIATION, Chicago—April 14-15.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS, National Open Hearth Steel Committee, annual meeting, Palmer House, Chicago—April 18-20.

MALLEABLE FOUNDERS' SOCIETY, western sectional meeting, Palmer House, Chicago—April 22.

**American Foundrymen's Society, 53rd Annual Foundry Congress, St. Louis—May 2-5.**

INSTRUMENT SOCIETY OF AMERICA, annual spring meeting, Royal York Hotel, Toronto, May 12-13.

SOCIETY FOR EXPERIMENTAL STRESS ANALYSIS, spring meeting, Hotel Statler, Detroit—May 19-21.

MALLEABLE FOUNDERS' SOCIETY, western sectional meeting, Palmer House, Chicago—May 27.

STEEL FOUNDERS' SOCIETY OF AMERICA, industrial relations meeting, Drake Hotel, Chicago—June 9-10.

MALLEABLE FOUNDERS' SOCIETY, annual meeting, Homestead Hotel, Hot Springs, Va.—June 16-17.

AMERICAN SOCIETY FOR TESTING MATERIALS, annual meeting, Atlantic City, N. J.—June 27-July 1.

MICHIGAN REGIONAL FOUNDRY CONFERENCE, A.F.S. Michigan Chapters, Michigan State College, East Lansing—Nov. 15-16.

## New Apprentice Training Standards For Foundry And Pattern Shop Out

A. F. S. APPRENTICE TRAINING STANDARDS FOR THE FOUNDRY INDUSTRY, latest Society publication, gives complete information on establishing a foundry or patternmaking apprentice training course. Developed by the Educational Division's Apprentice Training Committee, the standards cover the field from the need for apprentice training to sample apprentice contracts and includes information on aptitude tests.

A 6 x 9 in. paper covered book, the publication outlines work experience and related training and gives recommended number of weeks and hours for molding, coremaking, wood patternmaking and metal patternmaking apprentices. Administration of individual plant and community apprentice plans are described in the book, as is operation under the Federal Apprentice Training Service.

In addition to listing books and films suitable for apprentice training, the new book discusses tools needed by apprentices and lists those considered essential. The A. F. S. Apprentice Contest—now in its 26th year and open in 1949 until March 15—is also outlined in the publication.

Companion piece to A. F. S. APPRENTICE TRAINING STANDARDS FOR THE FOUNDRY INDUSTRY is an apprentice training course outline, now in final stages of preparation by the Apprentice Training Committee and already adopted by the New York State Education Department as the basis for a series of foundry instruction manuals being developed.

A. F. S. APPRENTICE TRAINING STANDARDS FOR THE FOUNDRY INDUSTRY is $1.00 to Society members, $1.50 to non-members.

Apprentice Training Committee members who prepared the new publication are: W. H. Ruten, Polytechnic Institute of Brooklyn, *chairman;* B. L. Bevis, Caterpillar Tractor Co., Peoria, Ill.; J. A. Bowers, American Cast Iron Pipe Co., Birmingham, Ala.; J. G. Goldie, M. B. M. Foundry, Inc., Cleveland; J. E. Goss, Brown & Sharpe Mfg. Co., Providence, R. I.; D. F. Lane, Bethlehem Steel Co., Sparrows Point, Md.; Henri Louette, Warden King, Ltd., Montreal; and G. W. Schuller, Caterpillar Tractor Co.

# COST CONTROL PLUS INCENTIVES

## *The Keys To Profitable Foundry Operation*

**Arthur A. Clay**
**Cost Consultant**
**Lima, Ohio**

FROM MANAGEMENT'S VIEWPOINT, foundries are operated primarily for two purposes—to make good castings at reasonable prices—and to make them at a profit. In the fulfillment of these aims, costs must be estimated accurately when quoting prices, and it is even more imperative that these costs be controlled.

In many progressive foundries, during recent years, the installation of adequate cost finding and cost control systems, plus wage incentive, bonus and profit sharing plans, has not only increased profits substantially but has materially lowered production costs. Further, labor relations have improved because employees are enjoying higher take-home pay from increased production.

Lack of control over costs by production centers and by patterns, plus the lack of sound employee incentive plans, have caused many foundries to sell castings at unprofitable prices—in many instances the same type of castings which their competitors are selling at a satisfactory profit. The small margin or lack of profit existing today in many industries—including the foundry industry—can be traced largely to lack of knowledge and control of the difference between production and sales costs. This same lack of knowledge not only affects the profits of the foundry responsible—it forces competitors to meet an unjust price.

### Principles of Castings Production

There is no substitute for continuous, efficient, low-cost, high-quality casting production to assure a lasting prosperity to the foundry industry. All substitutes result not only in poor quality castings and higher prices—they contribute to inflation and unemployment and can finally result in a depressed industry.

Foundrymen must realize at all times that they are required to adhere to certain basic principles in the production of castings. They are:

1. A complete understanding of the requirements and cost of a job before accepting orders.
2. Knowledge as to whether a proposed job fits existing plant facilities of the foundry.
3. A definite production plan for each casting, including an accurate predetermined cost estimate.
4. Establishment of an adequate cost system.
5. Adequate skill, capable management, and efficient and balanced supervision of workers.
6. Plant "know-how."
7. Modern plant methods and equipment, to assure a minimum of down time and low maintenance.
8. Profits of one class of work must not be made to carry losses from other classes.
9. A monthly budget, to be prepared at least 10 days prior to the beginning of the month, with variances therefrom available for investigation shortly after the end of the month.
10. The break-even point on a job should be known at all times.
11. There must be coordination between all departments of a company and full and sympathetic co-operation from employees.
12. Establishment of sound wage incentives for rewarding deserving employees. These rewards should be in direct ratio to accomplishment whenever possible.

### Importance of Cost Accounting

Although the importance of accurate, dependable technical information and the value of modern methods and equipment are recognized as vital to the industry, foundrymen have not generally accepted the importance of a modern system of cost finding and control, supported by time and motion study and sound employee incentives.

Cost predetermination and cost accounting are two of the most neglected aspects of foundry operation. Adequate profits cannot be assured unless provision is made for a practical system of evaluating costs by patterns for use in making quotations and for an adequate staff to operate the system.

Past experience has demonstrated that it is dangerous to base selling prices of individual castings on an over-all average "scoop shovel" cost per ton. Nevertheless, many foundries are still using this outdated system and in general getting unsatisfactory results with it. They are losing money because the procedure is unsound—most foundries using this practice will sooner or later find themselves with a production backlog of unprofitable work.

Foundries with established cost control systems know before accepting an order whether or not they will make a profit thereon and can determine fairly accurately just how much that profit will be. After each job has been shipped, if there is by some chance a discrepancy between actual and anticipated profits, the causes are thoroughly investigated and steps are taken to prevent a repetition.

Under the cost control system, planning committees

Condensed from a talk by Arthur A. Clay, cost consultant, Lima, Ohio, presented before the Birmingham District Chapter.

plot each major job in order to produce and deliver the best possible castings at the lowest cost in the shortest time. These planning committees can make or break a company and should therefore be composed of the most able men in the organization and should include members of the cost department and the time and motion study department.

A production center cost system furnishes periodic comparisons of operating efficiencies between the various production centers in a foundry. Thus, the efficiency of each center can from time to time be checked against predetermined standards of performance.

A production center is made up of the total area occupied by like machines or equipment, plus the space necessary for materials and tools, and space for the operators to work with freedom.

For example, in the cleaning department the production centers are: sprue cutting, burn-off, flogging, blast, chipping, grinding, straightening, pickling, etc.

The molding department may be broken down into five cost production centers—squeezer molding, pin lift molding, floor molding, sand, pouring, and shakeout.

### Production Center Make-up

The number of production centers required in establishing a cost control system will vary with individual foundries. Some may want several centers in a department, others very few. A simple rule, too often neglected in cost control, is to "arrange for joint participation in setting up production center budgets between top management, the cost department, and the men who will operate under them." Unless the supervisors share in the work of setting goals and are satisfied that these goals are fair, *before* they are started, they will not be sympathetic with the requirements and will fight them—instead of fighting to get them.

The successful operation of a production center cost system depends upon how accurately direct labor is recorded. If "everything but the kitchen sink" is buried in direct labor, then the system will fail miserably. Anything that has the slightest resemblance to overhead should be removed from direct labor and charged to overhead, otherwise the overhead rates will be understated. All expenses should be broken down into two major groups—fixed and variable.

Production center cost accounting directs attention to and localizes any inefficiencies in management; spotlights high labor, material and overhead costs; and directs attention to poor methods, inefficient machines and equipment. Above all, it places the blame for unprofitable operation right where it belongs—on the foreman of that particular production center responsible for high cost and inefficiency.

In many instances too little emphasis has been and is being given to the design and detail requirements of the individual casting; the yield; the burn-off, chipping, and grinding area; the core content; heat treating; hospitalization work; and handling cost.

To get the most out of a cost control system, a foundry should have a sound wage incentive plan for its workers, a bonus plan for its supervisors, and a profit-sharing plan for its executives.

Many foundrymen have objected to cost control on the grounds that it entails endless "red tape" and the addition of a number of clerks to the office staff. It is true that a few extra clerks are required, but the results more than pay for themselves. The elimination of unnecessary work in an unorganized office would alone cut the cost of establishing a system to a minimum.

A production center cost system, furnishing cost data by production centers and by patterns, will not run itself. Neither will it in itself reduce costs or increase efficiency. This is up to top management and the foremen. Unless management is progressive and cost data are properly interpreted a cost system is a waste.

Competition today makes it necessary to make a periodic cost analysis of all phases of foundry operations, machines, methods and equipment. Cost saving possibilities should be reviewed again and again, even though previously discarded as being unnecessary or not worth the trouble. They may be worth the trouble —now more than ever!

It pays to investigate every avenue for labor cost saving, material cost saving and overhead reduction. Investigate the adequacy and efficiency of machines and equipment in each production center. Are they performing at a low competitive unit cost? Do they have excessive maintenance cost? Do they have excessive down time?

It is well to visit your competitors and find out what they are doing. Let them visit you by all means. Exchange ideas with them. Their ideas will often help to improve your operations. An industry, like a company, goes either forward or backward. Which direction an industry takes depends upon the cooperation and exchange of ideas between its members.

Competition from foundries whose prices are low, because of advantages secured by volume or by more efficient methods of production, is recognized and accepted by all foundrymen, but these same foundrymen dread competition from a foundry that sets its prices by guesswork, precluding the possibility of an adequate profit for everyone.

*Viewed by some of the country's top vocational educators was this castings exhibit of the Federal Malleable Co., Milwaukee, shown at the National Convention of the American Vocational Association, held in Milwaukee in December. The purpose of this exhibit, which was also shown at the ASME Convention in that city last June, is to inform educators and technical men outside the industry of the wide range of applications and special qualities of malleable iron.*

# Letters to the Editor

## Reports Latest Nodular Graphite Work

Since returning to Belgium we have conducted additional experiments on nodular graphite expanding the work reported in the 1948 Exchange Paper of the Belgian Foundrymen's Association to the French Foundrymen's Association (AMERICAN FOUNDRYMAN, January, 1949, pp. 55-62). The photomicrographs (see below) show the results of the recent work.

The first three result from samples of iron treated first with 0.5 per cent of magnesium, then with 0.2 per cent of a calcium-silicon alloy. Iron composition was: C, 3.33; Si, 2.73; Mn, 0.9; S, 0.04 (0.02 after Mg treatment); P, 0.10 per cent. The sulphur content may be very much higher and as far as we know at this moment the composition of the liquid iron is not very critical at all.

The greatest difficulty is still in the way of introducing the magnesium. We hope to find a satisfactory way to do this and to obtain a good though short-time emulsion of magnesium in the liquid iron. If the new methods we are thinking of succeed, we feel that very small additions may give results.

The last two photomicrographs show iron of similar composition, but with 2.11 per cent silicon, inoculated with 0.25 per cent lithium (which is probably far too much) but without other additions.

Test specimens cast were 0.4 in. in diameter. Larger specimens, 0.8 in. diameter and up, did not give nodules but a very curious structure that has to be studied. It seems that complex carbides (in case of lithium) decompose just a bit too early for those sections and that composition. Another feature is that nodules produced by lithium seem to be less compact.

PROFESSOR ALBERT DE SY
*Head*, Metallurgy Dept.
University of Ghent, Belgium

**Dr. De Sy's studies in the field of nodular graphite are significant contributions to the information on one of the major phenomena of modern metallurgy. For experiences with the addition of magnesium to cast iron see "Producing Nodular Graphite with Magnesium", pages 30-37, this issue. —*Editor.***

## Student Summer Workers Do Well

Recently we received the following letter from a foundryman who employed two Ohio State university students last summer during the 1948 summer vacation:

"Both of these men did an excellent job. Mr. _____ had been with us part-time as a sand testing technician and was transferred to a trainee status when Mr. _____ was hired.

"During the summer they worked in the melting, molding, coremaking, and cleaning departments, pattern shop and office. For two weeks they worked with plant supervision and management observing their duties. We made every effort to give them all information for which they asked, including much confidential financial and operating data.

"Mr. _____ especially made several suggestions which were adopted and both contributed much to our operations merely by interested observations.

"We believe this program has proven its worth and will be very much interested in hiring one or two trainees for summer work in 1949."

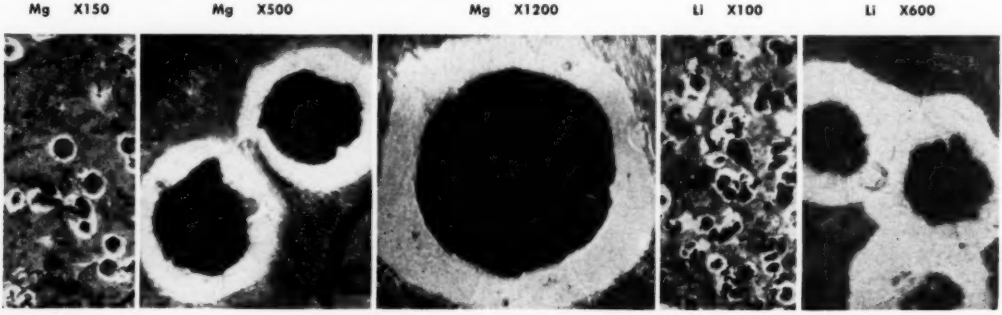
Summer work programs of the type briefly outlined will greatly improve chances of the foundry industry obtaining its share of engineering students graduating from the universities.

W. G. STANTON, *Assoc. Prof.*
Industrial Engineering Dept.
Ohio State University

**Summer work is required of all students in the OSU industrial engineering department. Regardless of the type of work they do, they are required to report on their summer activities to Professor Stanton. A considerable number of OSU students work in foundries during the summer and some are placed in the foundry industry on graduation each year. —*Editor.***

## Plans Chemical Laboratory

Customers of our small foundry are becoming more particular and we should have some way of analyzing castings. Does anyone make a kit that could be used



in the analysis of cast iron? Where can we get a book on analyzing cast iron?

W. WALLACE MCKAIG
McKaig's
Cumberland, Md.

**The cost of such a laboratory, according to a paper to appear soon in *American Foundryman*, is approximately $5000. This does not include the laboratory space, installation of equipment, plumbing, wiring or partitioning of rooms which may be desired. In addition, you should take into account the salary of the chemist or metallurgist who would make the analysis. In a small foundry such a man generally has other duties as well since a few analyses a day require only a small part of his time.**

**We know of no chemistry set available for determining the composition of cast iron. Apparatus and chemicals are generally assembled from stock items available from laboratory houses.**

**The American Society for Testing Materials, 1916 Race St., Philadelphia 13, Pa., publishes a widely-recognized book on methods of chemical analysis.**

**In examining possibilities for providing your foundry with laboratory service consideration should be given to the use of commercial laboratories specializing in this work. There is at least one such laboratory in every foundry center, and those at a distance from you can provide quick service through the use of air mail and long distance telephone.—*Editor*.**

# ALABAMA BECOMES SEVENTH FEF SCHOOL

SEVENTH SCHOOL TO BE CHOSEN by the Foundry Educational Foundation to carry out its program of foundry education on the college level, the University of Alabama has completed plans for the organization of foundry and metallurgical courses. The school will serve the foundry industry of the Southeast, including Alabama, Mississippi, South Carolina, Florida, Georgia, Tennessee, North Carolina, plus New Orleans and Baton Rouge in Louisiana. The 400 foundries within this area will be solicited for funds to finance the program.

The University of Alabama, chosen by the FEF as the result of requests by Southeastern foundrymen, was selected because of its proximity to a wide range of foundry operations. Dr. James T. MacKenzie, technical director of the American Cast Iron Pipe Co., Birmingham, head of the investigation committee, formally announced the choice at a luncheon, held October 15 and attended by industry executives from Birmingham, Tuscaloosa, Gadsden, Anniston, Knoxville and Chattanooga. President John M. Gallalee of the University of Alabama, Dean James R. Cudworth of the college of engineering, Professor E. C. Wright and Associate Professor Robert B. Oliver attended the luncheon and expressed the desire of the University to cooperate in every possible way with the Foundry Educational Foundation.

The foundry program will be set up in the College of Engineering by Dean Cudworth and will be actively directed by Professor Wright. The University's newly-created school of metallurgy offers a degree in metallurgy and provides preparatory study for chemical, mechanical, industrial and mining engineers, who are all required to take preparatory courses in metallurgy. After completing these courses, the student engineer will be able to enter directly into the following foundry studies:

1. *Fundamentals of the Casting Process*—A study identifying the technology and engineering required of foundry operations, and outlining the applications of castings.

2. *Foundry Technology I*—A study of the application of science to foundry operations. Includes control of materials and process, maintenance of tolerances, metallurgical inspection and repair.

3. *Foundry Technology II and III*—Continuations of Foundry Technology I.

4. *Casting Design*—A study of patterns, molds and casting designs in their relationship to each other in the engineering of a foundry product. Emphasis on design of castings.

These courses, required of students following the foundry program, will be incorporated into an option in the metallurgical engineering curriculum which will also include such required courses as accounting for engineers, business law, industrial organization, motion and time study, and study of the technique of executive control.

The college of engineering is also installing a series of studies in the humanities, which will include courses in man and his behavior, foundations of the modern world, the government of contemporary society, and problems of philosophy.

A group of 31 other engineering and business subjects has been selected as recommended electives available to all engineering students. Of unusual interest to foundry students is a course in ceramics.

Dean Cudworth and Professor Wright have stressed their intentions of conducting all foundry laboratory work on an engineering level—a policy which the University of Alabama believes will fully equip its engineering graduates for technical and managerial positions in the foundry industry.


***URGENTLY NEEDED!***

**VOLUME 48 (1940) TRANSACTIONS**

Bound copies of this volume in good condition will be purchased by A. F. S. Headquarters. Members who have no further use for their copies are urged to write The Secretary, American Foundrymen's Society, 222 W. Adams, Chicago, 6.

## Old Timer Recasts 1900 Convention Souvenir At Museum Foundry Exhibit

DAYS WHEN A.F.S. WAS YOUNG were recalled recently when Chicago's Museum of Science and Industry chose a souvenir miniature cast iron hat from the Society's

Fifth Annual Convention, held in Chicago, June 5, 6, 7, 1900, as a pattern for a casting demonstration at its foundry exhibit.

Old-time foundrymen William Carty and Alexander Dapogany, who operate the exhibit, were looking around for some object of foundry interest to cast for one of their regular public demonstrations when Mr. Carty recalled the miniature cast iron hat he has had for almost half a century. Rummaging around among his possessions, Mr. Carty found the hat, took it to the Museum, made a mold from it, and with Mr. Dapogany cast it during one of the Museum's regular casting demonstrations.

Mr. Carty acquired the hat, an iron replica of the black homburgs popular in the "Gay Nineties," while he was an apprentice molder at the old J. H. Bass Foundry, 47th St. and Wentworth Ave., Chicago. Inscribed "Fifth Annual Convention, American Foundrymen's Association, Chicago, June 5, 6, 7, 1900," the miniature serves as a combination paperweight, ash tray and cigar holder.

"Now that this hat is an 'old timer' like myself," Mr. Carty said in presenting the trophy to the Society, "I'd like to have it placed on display where other foundrymen who grew up with A.F.S. can see it and recall the good old days."

A.F.S. will do just that at the 1949 Convention, to be held in St. Louis May 2-5, when the hat will be on display at the Old Timers Booth, where the foundry industry's veterans, many of whom were present at some of the first Conventions, will see it as they sign the A.F.S. Old Timers Register and add another 25 or 50-year button to their collections.

## Chapter Holds Educational Meetings

DESIGNED TO HELP THE HIGH SCHOOL STUDENT to obtain reliable information about the foundry industry, Saginaw Valley Chapter's third annual series of educational meetings will begin March 3 at Flint, Mich. Meetings will be held on successive Tuesdays.

The first session will be devoted to the importance of the foundry in everyday life, and to types of foundry training available. The second session will include a talk, exhibit and film on materials and foundry production. The third meeting, with the aid of motion pictures and slides, will feature further explanations of foundry operation.

The final session will be a round table discussion on the making of a specific casting. Foundrymen representing management, pattern equipment, metallurgy, production and costs will participate, and slides and samples will be used to help with the discussion.

## Central Illinois Chapter's Foundry Exhibit Arouses Interest Of Public

DESIGNED TO STIMULATE interest in the foundry industry in Central Illinois, an exhibit shown in the Commercial National Bank, Peoria, Ill., and sponsored by the Central Illinois chapter of the American Foundrymen's Society, was viewed by hundreds of Peorians from December 3 to December 10, inclusive.

The exhibit explained the evolution of a casting from its blueprint stage, through the master pattern, metal pattern equipment, mold, rough casting with riser and gates intact, to finished casting. Representative castings in malleable iron, brass, aluminum and gray iron produced by Central Illinois chapter member foundries were also exhibited.

Each casting in the display was identified only as to its type and use, with no mention being made of

the foundry producing it. Placards were also displayed giving pertinent facts regarding the foundry industry in Illinois.

After attracting a great deal of favorable comment from local residents who viewed it in the bank building, the exhibit was moved to the Peoria Vocational School, where machine shop and foundry courses are taught and where it is currently on display. It is the intention of the chapter to display the exhibit in as many area high schools as possible, in order to create interest in the foundry industry on the part of students.

# New A F S MEMBERS

**Period December 15-January 15: Year's end gain in A. F. S. membership is 99, with 27 chapters and five foreign countries contributing to the increase. Leading chapters during this period were Ontario, 12; Saginaw Valley, 8; Eastern Canada & Newfoundland, 7; and Southern California, 7.**

## NEW COMPANY MEMBERS

**Compania Argentina de Talleres Industriales, Buenos Aires, Argentina**—Alfredo B. Gatti, Directing Manager—Conversion from Personal.

**Lake Erie Foundry Co. Inc., Buffalo, N. Y.**—Reinhold D. Loesch, President—Conversion from Personal (Western New York Chapter).

**Lundin & May Foundry Co., North Salt Lake City, Utah**—Jack F. May, General Manager (Timberline Chapter).

**Tonawanda Engineering Co., Tonawanda, N. Y.**—(Western New York Chapter).

## CENTRAL INDIANA CHAPTER

Carl L. Brandt, Chief Foundry Cost Accountant, International Harvester Co., Indianapolis.
R. Kenneth Guise, Student, International Harvester Co., Indianapolis, Ind.
John H. Schilling, Fmn., International Harvester Co., Indianapolis, Ind.
Chester D. Sears, Asst. Fdy. Met., International Harvester Co., Indianapolis.

## CENTRAL OHIO CHAPTER

Harold H. Jenkins, Gen. Fmn., Portsmouth Steel Corp., Portsmouth, Ohio.
Howard Riegger, Instructor, Boys Trade School, Columbus, Ohio.

## CHICAGO CHAPTER

Wm. E. Adams, Jr., Melt. Supv., Chicago Steel Foundry Co., Chicago.
Eugene W. Smith, Jr., Student, Wright Jr. College, Chicago.

## CINCINNATI CHAPTER

William G. Hibbs, Jr., Student Engr., The Haven Malleable Castings Co., Cincinnati.
George Kennison, Molding Fmn., Bardes Forge & Foundry, Cincinnati.
Elmer Ellsworth Krebs, Jr., Apprentice, Cincinnati Milling Machine Co., Cincinnati.

## DETROIT CHAPTER

Wm. E. Dougherty, Shop Engr., Chrysler Corp., Dodge Div., Detroit.
Herman Tagmeyer, Dostal Per Mold Fdy. Co., Pontiac, Mich.

## EASTERN CANADA & NEWFOUNDLAND CHAPTER

Alan S. Bellis, Lab. Tech., Crane Limited, Montreal, Que.
James H. Clark, Asst. Local Supt., Canada Iron Foundries, Ltd., Three Rivers, Que.
Douglas R. Draper, Radiographer, Crane Limited, Montreal, Que.
Lucien Fortin, Fdy. Fmn., Canada Iron Foundries Ltd., Three Rivers, Que.
G. Lemay, Chief Draftsman, The J. A. Gosselin Co., Ltd., Drummondville, Que.
Jack Pringle, Local Supt., Canada Iron Foundries Ltd., Three Rivers, Que.
Bruce F. Richardson, Res. Engr., Steel Cstgs. Institute of Canada, Ottawa, Ont.

## METROPOLITAN CHAPTER

Seymour Troy, Gen. Mgr., Eastern Metal Products Co., Tuckahoe, N. Y.

## MEXICO CITY CHAPTER

Aldo Parodi, Asst. To Grey Iron & Pipe Fdy. Supt., Altos Hornos, De Mexico, S. A., Monclova, Coahuila, Mexico.

## MICHIANA CHAPTER

Harry D. Hunt, Fdy. Supt., Auto Specialties Mfg. Co., St. Joseph, Mich.
Ralph A. Stickley, Fmn. of Pattn. Shop, Oliver Corp., South Bend, Ind.
Donald Lee Yost, Black Products Co., St. Joseph, Mich.

## NORTHEASTERN OHIO CHAPTER

Willard R. Hohl, Student, Case Institute of Technology, Cleveland.
Donald M. Morrison, Sls. Engr., The American Fire Clay & Prod. Co., Cleveland.
Steve Pietrzyk, Supt. of Maint., Allyne-Ryan Foundry Co., Cleveland.

## NORTHERN CALIFORNIA CHAPTER

A. R. Del Carlo, Fmn., Bethlehem Steel Co., S. F. Yard, San Francisco.
John G. Medeiros, Fmn., Phoenix Iron Works, Oakland, Calif.
Jerold C. Plaza, Core Room Fmn., Phoenix Iron Works, Oakland, Calif.
Clayton D. Russell, Phoenix Iron Works, Oakland, Calif.
Weldon L. Russell, Phoenix Iron Works, Oakland, Calif.
Jack E. Smith, Sls. & Service, Clementina Company, San Francisco.

## NO. ILLINOIS & SO. WISCONSIN CHAPTER

Claude White, Partner, Rockford Transmission Supply Co., Rockford, Ill.

## NORTHWESTERN PENNSYLVANIA

Edward E. Richardson, Fmn., Chicago Pneumatic Tool Co., Franklin, Pa.

## ONTARIO CHAPTER

Tom Ayres, Radiator Fmn., The Gurney Fdy. Co., Ltd., Toronto, Ont.
Roy Ayres, Boiler Fmn., The Gurney Fdy. Co., Ltd., Toronto, Ont.
William H. L. Bryce, International Harvester Co. of Canada, Hamilton, Ont.
George Cox, Cupola Fmn., The Gurney Fdy. Co., Ltd., Toronto, Ont.
James Fitzhenry, Coreshop Fmn., The Gurney Fdy. Co., Ltd., Toronto, Ont.
Cliff Gilbert, Fdy. Supt., The Gurney Fdy. Co., Ltd., Toronto, Ont.
Robert Hetrick, Sls. Engr., Metals & Alloys Ltd., Toronto, Ont.
Gerald A. Kelly, Sand Tech., The Gurney Fdy. Co., Ltd., Toronto, Ont.
Gerald P. McCabe, Draftsman, The Gurney Fdy. Co., Ltd., Toronto, Ont.
W. S. Miller, Asst. to Wks. Mgr., Massey Harris Co., Ltd., Brantford, Ont.
Oliver W. Sneddon, Walker Metal Products Ltd., Windsor, Ont.
Thomas F. Taylor, Wood Pattn. Maker Fmn., The Gurney Fdy. Co., Ltd., Toronto, Ont.

## OREGON CHAPTER

George Becker, Cupola Fmn., Crawford & Doherty Fdy. Co., Portland, Ore.
Joseph Cifu, Coreroom Fmn., Crawford & Doherty Fdy. Co., Portland, Ore.
Harlow H. Hickox, Coremaker, Electric Steel Foundry, Portland, Ore.

## QUAD CITY CHAPTER

James M. Green, Fdy. Mgr., Des Moines Stove Repair Co., Des Moines, Iowa.
Wm. H. Richardson, Asst. Fdy. Supt., John Deere, Waterloo, Iowa.

## SAGINAW VALLEY CHAPTER

Bruce B. Ball, Student, General Motors Institute, Flint, Mich.
Richard D. Beever, Student, General Motors Institute, Flint, Mich.
Neal F. Cary, Time Study, Chev. Gray Iron Fdy., General Motors Corp., Saginaw, Mich.
Paul Stanford Lape, Relief Man, Buick Motor Div., General Motors Corp., Flint, Mich.
John Olszewski, Fdy. Fmn., Central Fdy. Div., General Motors Corp., Saginaw Mall. Iron Plant, Saginaw, Mich.
Ralph W. Pearce, Estimator & Time Study, Chev. Gray Iron Fdy., General Motors Corp., Saginaw, Mich.
David A. Wigley, Co-op Stu., General Motors Tech., Chev. Gray Iron Fdy., General Motors Corp., Saginaw, Mich.
Andrew J. Wojcik, Fmn., Core Dept., Chev. Gray Iron Fdy., General Motors Corp., Saginaw, Mich.

## ST. LOUIS DISTRICT CHAPTER

E. K. Buxton, Fdy. Supt., Walworth Co., E. St. Louis, Ill.
Gabriel L. Leibler, Process Insp., General Steel Castings Corp., Granite City, Ill.
Floyd Roper, Process Insp., General Steel Castings Corp., Granite City, Ill.

### SOUTHERN CALIFORNIA CHAPTER

Ralph M. Enriquez, Owner, Aluminum Products, Los Angeles.
David Halliday, Pattern Maker, Pacific Pumps, Inc., Huntington Park, Calif.
Elmer B. Hammond, Owner, Pacific Pattern, Los Angeles.
Ernest H. Jenkins, Gen. Fmn., Compton Foundry, Compton, Calif.
W. R. Patterson, Met., The National Supply Co., Torrance, Calif.
Pat Pellegrino, Jr., Student, Monarch Aluminum Castings Co., South Gate, Calif.
Claude Whitsett, Jr., Fmn. Pattn. Shop, Westlectric Castings, Inc., Los Angeles, Calif.

### TENNESSEE CHAPTER

Louis Richelson, Owner, Richelson Coal, Iron & Metal Co., Chattanooga, Tenn.

### TEXAS CHAPTER

I. K. Fussell, Chief Engr., Schlumberger Corp., Houston, Texas.
William K. Griffis, Asst. Prof. of Mech. Engr., University of Texas, Austin, Texas.
King C. Tetley, Fdy. Supv., Nibco, Nacogdoches, Texas.

### TIMBERLINE CHAPTER

Lundin & May Foundry Co., North Salt Lake City, Utah (Jack F. May, Gen. Mgr.)

### WESTERN NEW YORK CHAPTER

Albert E. Eisele, Time Study, Lake Erie Foundry Co., Buffalo, N. Y.
W. H. Oliver, Gen. Supt., American Radiator & Standard Sanitary Corp., Buffalo, N. Y.
Martin Plots, Gen. Fmn., Lake Erie Foundry Co., Buffalo, N. Y.
Marve Taublieb, Sls. Engr., Johnson March Corp., Buffalo, N. Y.
Tonawanda Engineering Co., Tonawanda, N. Y.

### WISCONSIN

George F. Ryan, Fdy. Acct., Allis-Chalmers Mfg. Co., West Allis, Wis.

## STUDENT CHAPTERS

### MISSOURI SCHOOL OF MINES & METALLURGY

Elmo G. Knutson

### OREGON STATE COLLEGE

Altan V. Fullaway — Ardell L. Scott

### TEXAS A. & M.

William T. A. Caraway — Malcolm E. Wade
David L. Fort.

## OUTSIDE OF CHAPTER

Henry M. Frechette, V. P. & G. M., Fitchburg Foundry, Inc., Fitchburg, Mass.
Henry B. MacKinney, Fdy. Supt., Butler Machine & Foundry Co., Butler, Pa.
H. D. Newell, Chief Met., The Babcock & Wilcox Tube Co., Beaver Falls, Pa.
Ross W. Richards, J. S. White Co., Pawtucket, R. I.
Harold B. Scott, Fdy. Supt., Calorizing Co., Pittsburgh, Pa.

**Belgium**
Albert L. De Sy, Professor, University of Ghent, Ghent, Belgium.

**France**
Henri Perchat, Ingenieur en Chef des Services Techniques de Fonderie, Regie Nationale des Usines Renault, Billancourt (Seine) France.

**Holland**
P. W. Doesborgh, Paul Julien Periodieken-Import, Tegelen, Holland.

**India**
Bushir Henry, Angus Engineering Works, Bengal, India.

**Italy**
Aldo Alliata, President, Metallurgica Vittorio Cobianchi, Province Novara, Italy.
Mario Olivo, Met. Engr., Impianti Fonderie Olivo, Milano, Italy.

## AMERICAN FOUNDRYMAN To Accept Classified Ads, Professional Cards

RESPONDING TO REQUESTS of prospective advertisers, AMERICAN FOUNDRYMAN is establishing departments for classified advertisements and for professional cards. Increasing its service to advertisers and readers "The Foundrymen's *Own* Magazine" adds these new departments to the A. F. S. Employment Service column started late last year to serve members of the American Foundrymen's Society seeking men or positions.

Classified advertisements provide an opportunity for everyone to publicize open foundry capacity available or wanted, and plants, equipment and materials to sell or to buy.

Professional cards advertise professional foundry services of consultants, laboratories, and research and engineering organizations.

Basic rate for classified advertisements and professional cards is $10.00 per column-inch per month with a maximum of 50 words per inch. Employment Service fees will continue to be $10.00 for firms inserting help wanted items and $5.00 for individual members of A.F.S. inserting position wanted items.

Items intended for any one issue of AMERICAN FOUNDRYMAN must be on file with A. F. S. Headquarters by the 24th of the month preceding date of publication. Publication date is the 15th of each month. Cancellations cannot be accepted later than the 1st.

## Naval Research Laboratory To Show Gating Films at A.F.S. Convention

TWO TECHNICAL REPORTS in motion picture form, tentatively titled *"Finger Gating"* and *"Step Gating,"* will be presented at a special, joint evening session of the A.F.S. Gray Iron and Steel Divisions at the 53rd Annual Convention of the American Foundrymen's Society, St. Louis, May 2-5.

The 16-mm color films will be presented by William H. Johnson and W. O. Baker of the Naval Research Laboratory, Washington, D. C.

## Officers Review Society Progress At 1948-49 Mid-Year Board Meeting

PROGRESS IN A.F.S. OPERATIONS for the first half of the 1948-49 fiscal year and current status of the 53rd Annual A.F.S. Convention (St. Louis, May 2-5) were discussed at the mid-year meeting of the Board of Directors, January 14, Bismark Hotel, Chicago.

Presiding was President W. B. Wallis, Pittsburgh Lectromelt Furnace Corp., Pittsburgh, with Vice-President E. W. Horlebein, Gibson & Kirk Co., Baltimore, and the following directors in attendance: H. A. Deane, American Brake Shoe Co., New York; J. E. Kolb, Caterpillar Tractor Co., Peoria, Ill.; H. G. Lamker, Wright Aeronautical Corp., Wood Ridge, N. J.; B. L. Simpson, National Engineering Co., Chicago; E. N. Delahunt, Warden King, Ltd., Montreal; W. J. MacNeill, Dayton Malleable Iron Co., Dayton, Ohio; F. C. Riecks, Ford Motor Co., Dearborn, Mich.; J. M. Robb, Jr., Hickman, Williams & Co., Philadelphia; T. H. Benners, Jr., T. H. Benners & Co., Birmingham, Ala.; N. J. Dunbeck, Eastern Clay Products, Inc., Jackson, Ohio; A. M. Fulton, Northern Malleable Iron Co., St. Paul, Minn.; and V. E. Zang, Unitcast Corp., Toledo, Ohio.

In reviewing the past six months operations, national officers of the Society heard reports from Secretary-Treasurer Wm. W. Maloney and Technical Director S. C. Massari and discussed membership, finances, technical activities, publications and the work of the Chapter Contacts Committee.

C. K. Donoho, author of "Producing Nodular Graphite With Magnesium", Page 30, is widely known for his writings in the technical press and his frequent appearances as a speaker at technical meetings on such subjects as cupola melting, centrifugal casting and metallurgy . . . Born in Gallatin, Tenn., Mr. Donoho attended high school in Lake Wales, Fla., and received his B.A. in 1930 and M.S. in 1931 from Vanderbilt University . . . He joined the American Cast Iron Pipe Co. in 1931 as a chemist . . . Later became, successively, cupola foreman (1934-35); sales engineer (1935-36), melting superintendent (1936-38), plant metallurgist (1939-46) and is today chief metallurgist there . . . He is a member of the A.F.S. Steel Division's Program and Papers Committee and the Fluidity Testing Committee, ASM, SAE, AIME, AWS, SFSA and the Electro-chemical Society.

C. K. Donoho

E. Claude Jeter, author of *"Reclaim Ferrous Foundry Sand"*, Page 40, has written extensively and has spoken before numerous technical society meetings on foundry operations and developments . . . Born in Winnsboro, S. C., Mr. Jeter attended Clemson College there, graduating with a B. S. degree in Metallurgy in 1928 . . . Immediately upon graduation, he joined Ford Motor Co., Dearborn, Mich., as a metallurgist . . . From 1933 to 1945, Mr. Jeter was engaged in foundry development work for Ford, and in 1945 was appointed assistant superintendent of foundry . . . He was appointed superintendent of foundry, his present position, the following year . . . He is a member of the Executive Committee of the A.F.S. Gray Iron Division and the Cupola Research Committee and is chairman of the Committee on Welding (Standby).

E. C. Jeter

Arthur A. Clay, author of *"Cost Control Plus Incentives—The Keys to Profitable Foundry Operation"*, Page 58, has been a certified public accountant for 25 years in New York, New Jersey and Ohio, and has written extensively on foundry cost control for the trade press and has spoken before A.F.S. chapters on the subject . . . A graduate of New York University, Mr. Clay has been associated with a number of accounting firms in New York and New Jersey, and was for several years comptroller of the Ohio Steel Foundry Co., Lima, Ohio . . . Mr. Clay is an instructor in accounting at Ohio Northern University on accounting and taxation problems in his spare time, and each year speaks over Station WLOK, Lima, explaining taxes to the public . . . He is a member of the Alloy Casting Institute and advisory member, District Five, Cost Committee, SFSA. He is currently Springfield, Ohio, manager of the Mutual Benefit Life Insurance Co.

Edward D. Boyle, author of *"Promote Feed Metal Fluidity Through Insulating Material"*, Page 45, grew up within sight of the Puget Sound Naval Shipyard at Bremerton, Wash. . . . While still in his 'teens, Mr. Boyle did odd jobs around the Shipyard foundry while attending high school and later taking night courses in metallurgy . . . In 1920, he was appointed a molder at Puget Sound, remaining in that position until 1929, when he was appointed supervisor . . . Mr. Boyle received the Naval rating of Master Molder in 1943 . . . In following the work of earlier investigators who employed asbestos, gypsum and similar materials to maintain metal temperatures and fluidity, Mr. Boyle has conducted extensive experiments into the uses of diatomaceous earth for this purpose.

E. D. Boyle

Arthur K. Higgins (*"Special Techniques Reduce Composite Casting Losses"*, Page 54) holds a B.S. in Metallurgy from the University of Wisconsin (1928) and an M.S. from there in 1931 . . . Was a laborer and geologists's assistant during school vacations with Vinegar Hill Zinc Co., and Bunker Hill and Sullivan in Idaho . . . After graduation in 1928, Mr. Higgins went to work in the laboratory for American Smelting & Refining Co., and was transferred to the Technical Department prior to returning to school . . . Mr. Higgins became a member of the Research Department of the Globe Union Mfg. Co., Milwaukee, after receiving his M.S. . . . He joined Allis-Chalmers Mfg. Co., Milwaukee, three years later as a nonferrous metallurgist, his present position. . . . Mr. Higgins holds memberships in the A.F.S. and ASM.

A. K. Higgins

## A. F. S. Employment Service

To contact firms seeking personnel through "Help Wanted" items write to American Foundrymen's Society, 222 West Adams St., Chicago 6, designating Item Number and issue of AMERICAN FOUNDRYMAN in which published. A.F.S. Applicant Registration Form then will be sent to applicant for filling in and returning to A.F.S. Headquarters. The form will be sent by Headquarters to the firm.

All negotiations thereafter must be made between applicant and the company itself.

Firms desiring to contact applicants should write A.F.S. Headquarters on firm letterhead, designating Item Number and issue. Copy of applicant's Registration Form then will be sent to firms and all negotiations thereafter must be carried on direct with applicant.

### POSITION WANTED

**PW104—Metallurgist:** Available after July 1; will locate anywhere. Experience in sand testing and radiography, also in cupola operation, acid electric steel melting, hand squeezer molding, gating and risering, non-ferrous casting. Good technical background, graduate University of Minnesota, metallurgical engineering. Age 29 years. Interested in cost systems.

### HELP WANTED

**HW505—Sand and Clay Technician:** Male college graduate, preferably 30 to 35 years old, with actual experience to sell high-grade company's clay products, etc., in New Jersey-eastern New York state territory. Ferrous and non-ferrous foundries. In reply, state experience in full, personal information and salary expected. Replies held strictly confidential.

# FOUNDRY Personalities

**Chester K. Faunt,** Christensen & Olsen Foundry Co., Chicago, chairman of the Chicago chapter of A.F.S., was honored by the Non-Ferrous Founder's Society at a dinner and entertainment Jan. 11 at the Swedish Engineers Club, Chicago. Society President Fred Haack, Jr., Capital Brass & Aluminum Foundry Co., presented Mr. Faunt with a solid gold wrist watch on behalf of the NFFS in appreciation of his services to the Society. Mr. Faunt was one of the organizers of the NFFS and its active head from its inception in 1941 until 1944. From 1944 until 1948, he was a member of the Executive Committee and board of directors. More than a hundred leading Chicago founders and suppliers attended the dinner, as did members of the NFFS board of directors.

**Howard G. Hammer,** founder and first president and treasurer of the George J. Hagan Co., Pittsburgh, recently retired after 11 years in the furnace business.

**Carl E. Von Luhrte,** formerly sales manager of the Western Division of the Chicago Retort & Fire Brick Co., was recently promoted to the position of Director of Sales. **Robert P. Stevens,** formerly sales manager for the company's Eastern Division, has been appointed sales manager of the company.

**A. K. Lucas,** general manager of the Lancaster Foundry Corp., Lancaster, Ohio, has resigned to form the Hocking Valley Foundry, Inc., for the production of various types of gray iron castings. Mr. Lucas' foundry will occupy the plant formerly owned by the Logan Foundry & Machine Co., Logan, Ohio. Mr. Lucas was formerly associated with the Altens Foundry & Machine Works, Lancaster, and the Miller Foundry Co., Columbus, Ohio, prior to joining Lancaster Foundry.

**Gilbert R. Funk,** in charge of manufacturing and engineering for the Pump Division of the Waukesha Foundry Co., Waukesha, Wis., for 10 years, has been appointed works manager and elected a director of the company. Mr. Funk, who has been with the company for 20 years, developed several new types of pumps, speed drives and testers for the dairy and food processing industries while with Waukesha. In his new position, he will be in charge of all manufacturing and foundry operations at both the Waukesha and Watertown plants.

**Dr. Mary Baeyertz** has been named assistant chairman of the Metals Research Department of the Armour Research Foundation of the Illinois Institute of Technology, Chicago. Dr. Baeyertz was formerly supervisor of research at the South Works of the Carnegie Steel Corp., and is the author of the recently-published book, "Non-Metallic Inclusions in Steel". Dr. Baeyertz was awarded her bachelor's degree from Smith College and her master's and doctor's degrees from Columbia University. She will assist Department Chairman William E. Mahin in general scientific supervision of numerous fundamental and applied research programs for industry and government agencies.

G. R. Funk

T. H. Beaulac

A. K. Lucas

G. L. Mitsch

**George L. Mitsch,** assistant plant manager of the St. Louis Foundry of the American Car & Foundry Co., has been named plant manager. Mr. Mitsch, who holds a B.S. in Metallurgical Engineering from the Missouri School of Mines and Metallurgy, first joined American Car & Foundry at Berwick, Pa., in 1940, leaving there in 1942 to accept a position with the Eastern Aircraft Division of General Motors Corp., at Trenton, N. J. In 1945, Mr. Mitsch returned to ACF in the St. Louis Foundry, later becoming assistant plant manager.

**William T. Bean, Jr.,** formerly products engineer for the Continental Aviation & Engineering Corp., where he was in charge of the Experimental Stress Analysis Laboratory, has opened a consulting service in product design and development at 5005 Parker Ave., Detroit 13.

**Philip H. Clapp, Jr.,** formerly sales representative for the Engineered Castings Division of the American Brake Shoe Co., has been appointed sales manager for that Division, according to an announcement by Division President N. George Belury. A graduate of the University of Michigan, Mr. Clapp joined Brake Shoe following service with the Navy as a lieutenant commander in World War II. He will continue to be located at the Division's headquarters in Rochester, N. Y.

**Thomas H. Beaulac,** for 18 years foundry superintendent for the Chicago Pneumatic Tool Co., Franklin, Pa., has resigned to become sales representative in Northern Pennsylvania for the Dayton Oil Co. A past director of the A.F.S. Northwestern Pennsylvania Chapter, Mr. Beaulac entered the foundry in 1907 at Hudson Falls, N. Y., and has since served in various foundry supervisory capacities in New York, New Jersey, Maine, Massachusetts and Canada. He will make his headquarters at 1346 Elk St., Franklin, Pa.

**Robert E. Barnett,** formerly chief of the Chemical Test Branch of the Army Chemical Center at Edgewood Arsenal, Md., has joined the Research and Development Laboratories of Sam Tour & Co., Inc., New York City. Mr. Barnett will specialize in research into the problem of air pollution of industrial plants for the Tour organization.

**Alfred A. Hilbron,** A.F.S. Convention and Exhibits Manager, was recently elected a director of the National Association of Exhibit Managers at that

**A. A. Hilbron**

Association's Annual Meeting, held December 16 and 17 in Chicago. Prior to joining A.F.S. in September, 1947, Mr. Hilbron was exhibit manager and later assistant manager of the Convention and Sales Department of Chicago's Hotel Sherman. He is a past president of the Illinois Hotel Sales Managers Association.

**Herbert J. Rosen,** since 1943 a vice president and director, recently succeeded

**H. J. Rosen**

**E. P. Waud**

**Ernest P. Waud** as president of Griffin Wheel Co. Mr. Rosen joined Griffin at

*(Continued on Page 82)*

# A. F. S. CHAPTER DIRECTORY

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*Secretary,* W. W. Edens, Badger Brass & Aluminum Fdry. Co.

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**STUDENT CHAPTERS**

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**OHIO STATE UNIVERSITY** *Secretary-Treasurer,* Arthur Stoner
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*Secretary-Treasurer,* Martin J. O'Brien
**OREGON STATE COLLEGE** *Secretary,* John P. Meece
**UNIVERSITY OF ILLINOIS** *Secretary,* Robert W. Bales
**TEXAS A & M COLLEGE** *Secretary,* Victor C. Henkel.

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*Party Committee members gathered at Central New York Chapter's 8th Annual Christmas Party, held December 11 at the Onodaga Hotel, Syracuse, N. Y., are, front row, left to right: J. W. Ogden, Cleveland Crane & Engineering Co.; David Dudgeon, Utica Radiator Corp.; John Feola, Crouse-Hinds Co.; J. O. Ochsner, Crouse-Hinds Co.; and W. D. Dunn, Oberdorfer Foundries. Back row, left to right: Frank Wheeler, Kinman & Wheeler Co.; C. M. Fletcher, Fairbanks Co.; Bruce Artz, Pangborn Corp.; J. P. Kratz, Crouse-Hinds Corp.; E. E. Hook, Dayton Oil Co.; and J. F. Livingston, of Crouse-Hinds Co.*

# CHAPTER ACTIVITIES NEWS

## Michiana

S. F. Krzeszewski
American Wheelabrator & Equipment Corp.
Publicity Chairman

TEN NEW CHAPTER MEMBERS were presented at the December meeting, held December 14 in the Bronzewood Room of the Hotel LaSalle, South Bend, Ind.

Membership Committee Chairman John Rush introduced the following new members: E. J. Wesolowski, foreman, The Oliver Corp.; R. R. Ashley, superintendent, Josam Foundry Co.; K. B. Wonnell, engineer, Peru Foundry; George M. Mitler, sales engineer, Mitler Supply Co.; D. Yost, Blake Products Co.; R. T. Clark, assistant chief metallurgist, and T. Nuzum, pattern engineer, Salisbury Axle Works; J. Folster, pattern shop superintendent, Weil-McLain Co.; R. A. Stickley, pattern shop foreman, The Oliver Corp.; and H. A. Ellison, Associated Engineers, Inc.

*Part of the overflow crowd of foundrymen that attended the Northwestern Pennsylvania Chapter's Annual Christmas Party, early last December.*

The guest speaker of the evening, Alexander D. Barczak, plant manager of the Superior Foundry Co., Cleveland, addressed the group on *"The Control of Synthetic Sand in a Production Shop"*.

Dividing his program into two parts—the first devoted to information and the second to answering questions, the speaker traced the history of sands and presented a comparison of the values of natural and synthetic sands.

Beginning with basic sand, Mr. Barczak outlined step-by-step the treatments required to produce good results under varied conditions, and explained in detail the effects of bentonites, clays, and wood flour upon sand. Mr. Barczak prescribed rules and formulas for obtaining uniform results in mixing sand.

Concluding his address, the speaker exhibited castings made using prescribed sand formulas. The castings were sound and had

good finishes. Mr. Barczak answered members' questions for more than an hour following the conclusion of his address.

### Cincinnati District

B. A. Genthe
S. Obermayer Co.
Chapter Secretary

"CASTING DEFECTS" was the subject of an address by W. B. McFerrin, Electro-Metallurgical Division of the Union Carbide & Carbon Corp., New York City, at the January 10 meeting, held at the Engineering Society, Cincinnati.

Mr. McFerrin, in listing some 30 types of casting defects, stated that the correction of such defects wherever possible will determine the success of any foundry, because the market is today changing from a sellers' market to a buyers' market. There are about 15 million tons of ferrous metals castings poured yearly, according to Mr. McFerrin, and thus a one per cent reduction in the number of rejects will produce an additional 150,000 tons of castings, representing a savings of some 30 million dollars.

No one man can solve all the problems that arise in a foundry, Mr. McFerrin said, and it is advisable to hold a conference of all persons involved in the making of a particular casting to determine means of remedying its defects. The speaker also stressed the necessity for proper evaluation on the part of a foundry as to the type of casting it is equipped to make. Trained personnel, Mr. McFerrin said, is vital to the industry and foundries should keep a close watch on the human element to insure that the right man is on the right job.

Mr. McFerrin covered such subjects as shrinks, blows, scabs and hot tears and suggested corrections for each defect. For more complete information on castings defects, Mr. McFerrin recommended the A.F.S. publication, ANALYSIS OF CASTING DEFECTS.

*Waiting for the stage show to begin at Northeastern Ohio Chapter's Annual Christmas Party were these lucky foundrymen who had front row seats for the show. (Photo courtesy S. N. Farmer, Sand Products Corp.)*

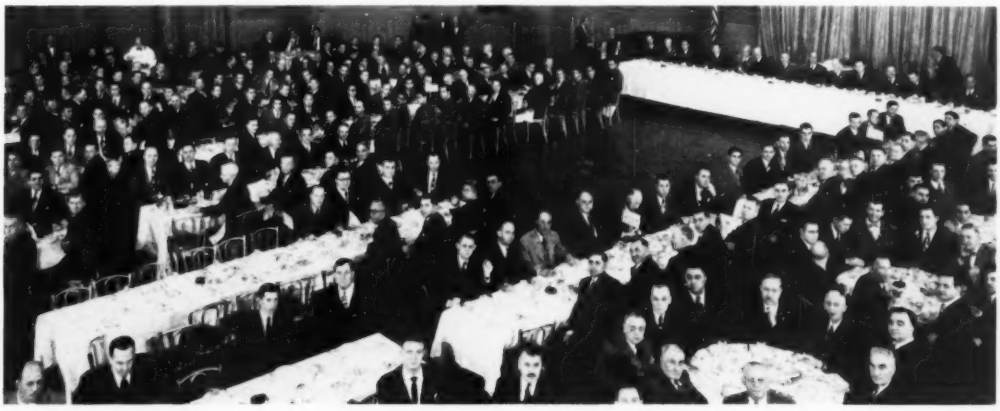
### Rochester

G. M. Etherington
Gleason Works
Chapter Reporter

DEDICATED TO PATTERNMAKING the December meeting, held at the Hotel Seneca, December 14, featured as guest speaker Ernest Kindt, president of the Kindt-Collins Co., Cleveland, Ohio. His subject was *"The Pattern Industry—Past, Present and Future Trends."*

Mr. Kindt spoke of pattern engineering as a key industry. First presenting a brief history of patternmaking, he said that the industry is still in its infancy and that there are many new developments yet to come. In discussing the plan of a new pattern shop and the selection and layout of equipment, Mr. Kindt mentioned the principles employed in figuring the cost of wood and metal patterns and in selling patterns and pattern equip-

*A few of the hundreds of foundrymen attending Metropolitan Chapter's Annual Christmas Party.*



*A few of the 250 foundrymen who attended Chicago chapter's first meeting of the New Year, held January 3 at the Chicago Bar Association.*

ment. Standardization of draft, colors, plates, methods and materials, he said, will be a big step forward for the industry. The speaker also mentioned the engineering and manufacture of plastic and plaster patterns.

According to Mr. Kindt, the pattern industry is entering a new era and has a great future ahead of it. With continued demand for lower cost castings, he said, the pattern industry will respond with new and better methods, materials and labor-saving machinery.

Following his talk and a discussion period, Mr. Kindt presented a 1600-foot motion picture emphasizing the highlights of his talk.

### Missouri School of Mines

**J. Absalom**
**Reporter**

A TECHNICOLOR FILM from the New Jersey Zinc Company on Die Casting was shown at the December meeting of the chapter.

Following the movie was the presentation of four papers by members of the local chapter. The titles and speakers were: *"Silicon and Titanium in Cast Iron"* by L. T. Smith, *"Precision Casting by the Investment Method"* by R. Renko, *"Air for Cupola Operations"* by J. Mitchell, and *"Problems of Foundry Management"* by L. Wiles.

The best paper was judged to be that given by J. Mitchell. Ten dollars were awarded to him and R. Renko received an A.F.S. publication of his own choice for having the next best paper.

The judges were Professors M. Cagg from the English Department and D. Walsh from the Metallurgical Department. All contestants were judged on their manner of presentation, their subject matter and its importance to the casting industry, and lastly, the apparent amount of work involved in the preparation of the talk. Both judges expressed the opinion that all the contestants did remarkably well and that judging was difficult.

At the next meeting on January 12 the student chapter played host to the St. Louis District chapter. A student trip to several St. Louis foundries was made later in January. An invitation for the trip and a joint meeting of the two chapters in the evening was extended to the student group by the St. Louis District chapter.

### Central New York

**John A. Feola**
**Crouse-Hinds Co.**
**Publicity Chairman**

THE EIGHTH ANNUAL Christmas Party of the Central New York Chapter was held Saturday evening, December 11 in the ballroom of the Onondaga Hotel, Syracuse. Party Chairman E. E. Hook, Dayton Oil Co., welcomed the 240 members and guests who attended and turned the evening's events over to his committee.

The program consisted of an old-fashioned turkey dinner, entertainment and a drawing for a large number of door prizes. A group of 15 foundrymen from the Hallstead Iron Co., Hallstead, Pa., won the distinction of having traveled the greatest distance to the party, and seven members from surrounding A.F.S. chapters were also present.

### Central Illinois

**V. W. Swango**
**Caterpillar Tractor Co.**
**Chapter Reporter**

THE THIRD ANNUAL CHRISTMAS PARTY and Ladies' Night of the Central Illinois Chapter replaced the regular December technical

*A.F.S. National President W. B. Wallis addresses the December 10 meeting of the Washington Chapter. Seated at the speaker's table are, left to right, J. Dolansky, Griffin Wheel Co.; Chairman George Rauen, Olympic Steel Works; E. Jones, Skagit Iron & Steel Co.; E. D. Boyle, Puget Sound Naval Shipyard.*

*Five hundred members and guests attended Cincinnati District's Christmas Party, December 11.*

meeting. Held at the American Legion Hall, Peoria, December 11, the party was attended by approximately 325 members and guests, who had their fill of turkey with all the "trimmin's", and thoroughly enjoyed a vaudeville show.

W. G. Schuller, Caterpillar Tractor Co., general chairman for the event, capably handled all details and is to be commended for making the party a huge success.

### Twin City

O. J. Myers
Werner G. Smith Co.
Chapter Reporter

MORE THAN 275 MEMBERS attended the Annual Christmas Party at the Hotel Radisson, Minneapolis, on December 17.

A sumptuous repast, consisting of more than a dozen fat turkey hens and a half-dozen hams, complete with all the trimmings, was served buffet-style to the stag line of foundrymen.

After the meal, an official, championship-size boxing ring was floodlighted for five excellent amateur bouts. Following this, the lights were dimmed and movie highlights of the 1948 Minnesota football games were shown.

Some 30 foundrymen were winners of door prizes, consisting of Mixmasters, radios, coffee-makers and other appliances.

### Washington

Fred R. Young
E. A. Wilcox Co.
Chapter Secretary

A.F.S. NATIONAL PRESIDENT W. B. Wallis was the featured speaker at the chapter's December 10 meeting held at the Gowman Hotel, Seattle. Mr. Wallis discussed the responsibilities of A.F.S. and its members in contributing to the progress of the foundry industry.

Preceding Mr. Wallis' address were two coffee talks, by Professor G. S. Schaller of the University of Washington, and Ernest Jones, Skagit Iron and Steel Co.

### Saginaw Valley

Norman J. Henke
Saginaw Malleable Iron Co.
Publicity Chairman

FOUNDRY EMPLOYEES of General Foundry, Flint, and the Buick Motor Car Co. Foundry, Flint, were guests of honor and were formally introduced to the rest of the chapter at the January 6 meeting, held at Fischer's Hotel, Frankenmuth, Mich. There was a sizeable turnout for the meeting, particularly because of the attendance competition between the two foundries. Clyde A. Sanders, vice-president of the American Colloid Co., Chicago, speaker of the evening, presented an interesting talk on *"Modern Progress in Molding Sand Practice"*.

### Chesapeake

Jack H. Schaum
National Bureau of Standards
Chapter Reporter

PATTERNMAKERS PREDOMINATED at the December 17 meeting, held at the Engineer's Club, Baltimore, to hear the speaker of the evening, Ernest T. Kindt, president of the Kindt-Collins Co., Cleveland.

Mr. Kindt traced the history of patternmaking back to the ancient Chinese, and then described the proper design of a modern pattern shop, its equipment, layout and tricks in estimating time and costs involved in making patterns.

Other subjects discussed by Mr. Kindt were the principles involved

*The buffet supper was both plentiful and delicious at Twin City Chapter's Annual Christmas Party. (Photograph courtesy Pufahl Foundry, Inc.)*

*A few of the members and guests present at Central Illinois Chapter's Annual Christmas Party were, left to right facing camera: C. Russell, Caterpillar Tractor Co.; Mr. and Mrs. L. D. Harkrider, General Aluminum and Gray Iron Co., Waukesha, Wis.; and Mr. and Mrs. W. G. Schuller, Caterpillar Tractor Co. Mr. Schuller was general chairman of the party.*

in selling patterns, standardization of pattern equipment, methods and materials. Applications of plastics and plaster to the patternmaking industry were discussed by the speaker, who concluded his address with a motion picture showing the manufacture of patternmaking supplies and equipment in the Kindt-Collins plant.

Prior to Mr. Kindt's talk, A.F.S. National Director John M. Robb, Jr., Hickman, Williams & Co., Philadelphia, addressed the group in his official capacity as a member of the A.F.S. Chapter Contacts Committee. The coffee speaker, Everett Beavin, chief engineer on the new Baltimore Airport construction job, told of the problems of construction encountered in building the airport, and the means employed to overcome them, and illustrated his talk with color slides showing earth digging, moving and packing equipment.

### Canton District

H. C. White
United Engineering & Foundry Co.
Chapter Reporter

"CUPOLA OPERATIONS" was the subject of an address by R. G. McElwee, manager of the Foundry Division of the Vanadium Corporation of America, at the January 6 meeting of the chapter.

Mr. McElwee, who is chairman of the A.F.S. Gray Iron Division and an internationally-known authority on cupola operation and the metallurgy of cast iron, based his address on the down-to-earth problems in cupola operation.

Following Mr. McElwee's address, the 93 members in attendance participated in a lively question-and-answer period.

### Central Indiana

W. K. Mitchell
L. W. & W. K. Mitchell Co.
Chapter Reporter

THE DECEMBER MEETING of the chapter, held December 6 at the Athenaeum, Indianapolis, featured an interesting talk by George F. Anselman, foundry superintendent, Woodruff & Edwards, Inc., Elgin, Ill., on *"Casting Defects in the Foundry"*. S. F. Swain, secretary and treasurer of the Golden Foundry Co., Columbus, Ind., served as technical chairman for the meeting, which was preceded by a dinner.

Mr. Anselman illustrated his talk with slides showing in detail the various defects common to castings. As each slide was shown, Mr. Anselman interrupted his talk to permit questions and discussion of the defect being shown. The speaker covered such topics as the proper mixing of sands, the uses of various bonding agents, and the proper placing of chaplets, as being vital elements in proper casting procedure. Mr. Anselman concluded his address by drawing attention to the dangers of lumps in cereal binders and gravel in molding sands.

The Chapter's January meeting, held January 10 at the Athenaeum, had as guest of honor A.F.S. National Director W. J. MacNeill, assistant to the president, Dayton Malleable Iron Co., Dayton, Ohio, and featured a question and answer panel, during which a panel of foundry experts answered questions and discussed foundry prob-

*Looking over lecture notes for the December 6 meeting of the Central Indiana Chapter are, left, George Anselman, Woodruff & Edwards, Inc., Elgin, Ill., guest speaker, and S. F. Swain, Golden Foundry Co., Columbus.*

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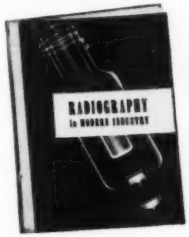


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# Chapter Meetings

### FEBRUARY 15

**CENTRAL MICHIGAN**
American Legion Club, Battle Creek
LEONARD F. TUCKER
City Pattern & Foundry Co.
*"Cooperation Between the Foundry & Pattern Shop"*

### FEBRUARY 17

**DETROIT**
Rackham Educational Memorial, Detroit
GROUP MEETINGS

**OREGON**
Heathman Hotel, Portland
GEORGE K. DREHER
Foundry Educational Foundation
*"Foundry Education"*

### FEBRUARY 17, 18, 19

**BIRMINGHAM DISTRICT**
Tutwiler Hotel, Birmingham
BIRMINGHAM REGIONAL FOUNDRY CONFERENCE

### FEBRUARY 18

**WASHINGTON**
University of Washington, Seattle
GEORGE K. DREHER
Foundry Educational Foundation
*"Foundry Education"*

**TRI-STATE**
Tulsa, Okla.
F. W. BURGDORFER
Missouri Pattern Works, Inc.
*"Plastic Patterns"*

### FEBRUARY 19

**CHICAGO**
Palmer House, Chicago
ANNUAL LADIES' NIGHT

### FEBRUARY 21

**QUAD CITY**
Fort Armstrong Hotel, Rock Island, Ill.
HIRAM BROWN
Solar Aircraft Co.
*"Aluminum Foundry Practice"*

### FEBRUARY 25

**ONTARIO**
Royal York Hotel, Toronto
F. JENSEN
National Engineering Co.
Film: *"New Foundry Horizons"*

**CHESAPEAKE**
Engineers' Club, Baltimore
WALTER BONSACK
Apex Smelting Co.
*"Aluminum and Magnesium Castings"*

### FEBRUARY 28

**TIMBERLINE**
Oxford Hotel, Denver
Film: *"Precision Casting by Investment Molding Process"*

### MARCH 1

**MICHIANA**
Rumely Hotel, La Porte, Ind.
WILLIAM GUDE
Penton Publishing Co.
*"Latest Developments in the Operating End of the Foundry"*

### MARCH 2

**TOLEDO**
Toledo Yacht Club, Toledo, Ohio
NATIONAL OFFICERS' NIGHT
GEORGE K. DREHER
Foundry Educational Foundation
*"Foundry Education"*

### MARCH 3

**SAGINAW VALLEY**
Flint, Michigan
EDUCATIONAL SERIES MEETING

**TWIN CITY**
Covered Wagon, Minneapolis
R. A. QUADT
American Smelting & Refining Co.
*"Aluminum or Non-Ferrous Metals"*

### MARCH 7

**CHICAGO**
Chicago Bar Association
CLYDE A. SANDERS
American Colloid Co.
*"Foundry Sand Practice"*

**METROPOLITAN**
Essex House, Newark, N. J.
R. A. QUADT
American Smelting & Refining Co.
*"Aluminum Foundry Practice"*

**CENTRAL ILLINOIS**
Hotel Jefferson, Peoria
HARRY J. JACOBSON
Industrial Pattern Works
*"Core Box Design and Rigging for Core Blowing"*

**CENTRAL INDIANA**
Athenaeum, Indianapolis
V. J. SEDLON
Master Pattern Co.
*"Modern Pattern Equipment"*

### MARCH 10

**SAGINAW VALLEY**
Flint, Mich.
EDUCATIONAL SERIES MEETING

### MARCH 11

**CENTRAL NEW YORK**
Onondaga Hotel, Syracuse
RALPH L. LEE
General Motors Corp.
*"Human Relations"*

**PHILADELPHIA**
Engineers' Club, Philadelphia
NON-FERROUS NIGHT

**EASTERN CANADA & NEWFOUNDLAND**
Mount Royal Hotel, Montreal
D. J. REESE
International Nickel Co.
*"Cupola Operation" & "Nodular Cast Iron"*

### MARCH 11, 12

**CENTRAL OHIO**
**CANTON DISTRICT**
**NORTHEASTERN OHIO**
**TOLEDO**
**CINCINNATI DISTRICT**
University of Ohio, Columbus
OHIO REGIONAL FOUNDRY CONFERENCE

### MARCH 14

**WESTERN MICHIGAN**
Cottage Inn, Muskegon
DR. RALPH L. LEE
General Motors Institute
*"Human Relations"*

### MARCH 15

**ROCHESTER**
Seneca Hotel, Rochester
W. B. MCFERRIN
Electro Metallurgical Co.
*"Gray Iron Castings Defects"*

### MARCH 17

**SAGINAW VALLEY**
Flint, Mich.
EDUCATIONAL SERIES MEETING

### MARCH 18

**WASHINGTON**
Gowman Hotel, Seattle
ROBERT GREGG
Reliance Regulator Co.
ALEX FINLAYSON
Pacific Car & Foundry Co.
*Subjects to be announced.*

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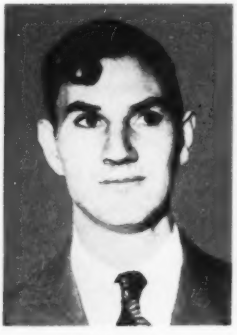
**Director**
**Central Indiana Chapter**



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**Chairman**
**Student Chapter**

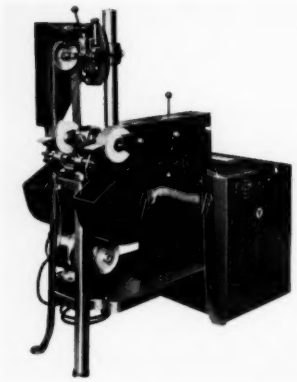
**J. Graham**
Mainland Foundry Co., Ltd.
Vancouver
**Director**
**British Columbia Chapter**

# NEW Foundry Products

**Readers interested in obtaining additional information on items described in New Foundry Products should send requests to Reader Service, American Foundryman, 222 W. Adams St., Chicago 6, Ill. Refer to the items by means of the convenient code numbers.**

### Grinder and Polisher

**FB1**—Designed to do a number of operations formerly done on heavier and more expensive machines, the Type H grinding, polishing and deburring machine has been



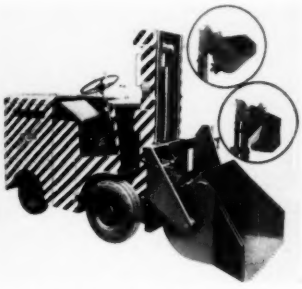
developed by the Delta Manufacturing Division of the Rockwell Mfg. Co. This machine uses coated abrasive belts instead of wheels and is portable. This completely condensed unit occupies a minimum of floor space and is adaptable to the use of two different quality belts at the same time, resulting in speed-up in the production of small parts requiring more than one finishing operation. All four basic models consist of arbor head, idler unit, straight-faced contact roll and abrasive belts. Aluminum oxide belts in four different grits are available for general purpose on steel, brass, forgings, and die castings. Silicon carbide belts are recommended for hard materials of low tensile strength. Virtually any desired finish may be had with the Type H machine.

### Springless, Packless Air Valve

**FB2**—A general purpose air hose valve that has no springs, no packing, requires little thumb pressure to open, and instantly snaps tightly shut when actuating plunger is released is announced by Paul Valve Corp. The new valve is for any air line up to 100 psi and produces an unusually powerful air blast. The Paul air valve eliminates springs by using the well-known Bernoulli Theorem, which states that an object placed at the edge of a stream tends to move to the high-velocity, low-pressure center of that stream. The object in the valve is a stainless steel ball, forced into the air stream, thence to the seat. The valve is operated by a thumb-actuated plunger that rolls the ball out of the seat. When plunger is released, ball hops back into the seat. Seal is of the positive, packless, O-ring type. Valve is of polished high-chromium stainless steel in all working parts and is available for ¼ or ¼ in. hose sizes, both with bodies tapped for standard ¼ in. pipe threads. Nozzle extends 2½ in., but longer nozzles are available.

### Self-Loading Scoop

**FB3**—An automatic self-loading scoop that loads itself automatically when driven into a pile of loose materials without the use of hydraulic cylinders or other auxiliary power is a feature of the Crescent



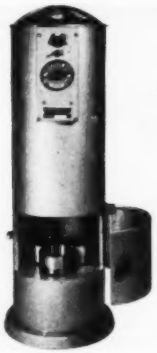
Truck Co.'s new line of 3,000 and 4,000 lb industrial fork trucks. The scoop can self-load 100 per cent of capacity in loose materials and as much as 60 per cent in ceramic clay of high moisture content. Loads are released at any predetermined height by a fixed trigger, or at any height within lifting range by a manually-operated lever. Hydraulic self-actuating cylinder and metering valve assure dumping at any desired speed. Scoop is mounted on standard carriage plate and is easily interchangeable with standard forks.

### Aluminum Alloy Enamels

**FB4**—A new vitreous enamel that is fired on aluminum strips, sheets and castings in furnaces similar to those used to apply porcelain to steel, has been developed by the DuPont Co. after six years of research, and is now ready for large scale evaluation by the aluminum and enameling industries. Vitreous enameled aluminum sanitary ware and accessories, washing machine tubs and agitators, architectural tile and outdoor furniture are among the immediate prospects for evaluation. Enameled aluminum is unusually marresistant, and if accidentally chipped or cracked will not rust. Present research has developed satisfactory enamels for two aluminum alloys, 61-S Wrought Alloy and 43 Casting Alloy. The new enamels contain a high percentage of lead, making them unsatisfactory for coating articles that are likely to come into contact with food. Tests have shown that the resistance of the enamels to acids and alkalis is comparable to that of enamel on steel. Equipment for applying the new enamels to aluminum is substantially the same as that for enameling steel, however, the aluminum enamels are fired at a temperature several hundred degrees below that employed in enameling steel, effecting economies in the initial cost and operation of furnaces.

### Laboratory Drying Oven

**FB5**—A Speed Oven for laboratory drying, claimed by the manufacturer Harry W. Dietert Co., to cut drying time in half has a drying space of 8 in. diameter by 6 in. high. Overall height of the unit is 29 in. Power requirements are 2800 watts at 115 or 230 volts. Motor driven fan



forces filtered air past electric heating elements. Air temperature is thermostatically controlled at any chosen drying temperature between 150 and 350F. Heated air flowing against and past the sample in the oven, rapidly picks up the moisture or volatile material, obtaining a rapid drying

rate. A 3-in. diameter atmosphere exhaust connection is provided so that the heated air and any obnoxious fumes may be piped into an exhaust hood or duct.

### Blueprint Cabinet

**FB6**—A cabinet that files blueprints safely and conveniently without wrinkles, creases or curled edges, the Draw-In-Dex

has been designed by the Empire Development Corp. to meet the problems of every organization using blueprints, photostats, charts and blow-ups. The cabinet accommodates 1,000 prints, hangs them smoothly, and makes them available for instant location by means of an index file. Any print can be moved without disturbing the others. Suspension rods support blueprints attached to manila hangars. Cabinet is 4 ft high, 2 ft 6 in. wide and 20 in. deep, in gray, green and mahogany.

### Air Compressor

**FB7**—An air compressor that "grows" to meet expanding requirements for air is announced by Air-Flo Compressor Co. The basic compressor uses 18 principal parts to construct a line of 48 models of 1, 2, 3, 4, or 6 cylinder pumps in single or two-stage types. All parts are interchangeable from the smallest to the largest pump. Thus a size pump suitable to present needs may be purchased, and as requirements for air expand, additional parts may be added to increase capacity. Air-Flo Compressors are available for prompt shipment in sizes from ½ to 40 hp with 2.5 to 275 cfm capacity at 30 to 300 lbs pressure in vertical, V type or side angle construction, with single, twin or radial staggered cylinder arrangements.

### Air Hammer

**FB8**—An air hammer that delivers 8,000 blows per minute, is designed by Superior Mfg. Co. to handle heavy chipping, sealing, chiseling and grooving jobs in foundries. A handle that fits the hand like a pistol grip releases the other hand of the operator to hold or turn the work piece. Finger pressure regulates power of hammer. Operates at full speed and power on less than 7 cfm at 80 psi. "Big Bully" is available with such optional accessories as routing chisel, flat scaling chisel, flat chisel, star drill, and spoon face chisel gauge. An eight-foot length of air hose is included in carrying case.

### Flexible Flashlight

**FB9**—A flexible flashlight that introduces light into inaccessible places. Flex-Lite, a product of the Aero-Motive Mfg. Co., is available in a choice of three types of extensions—braided shielding, flexible steel armor and neoprene insulated—and standard tubing lengths of 9, 18, 36 and 60 in. Woven braided metallic shielding

is recommended for general purpose work, where Flex-lite is used in the inspection and repair of light machinery. Flexible steel armor is extremely rugged and will stand indefinite abrasion in heavy-duty service. The neoprene insulated type is for use around electrical equipment. Extensions are available in the Model 55, which uses two penlite batteries, and the Model 75, powered by two D type cells.

### Pipe Hangar Fastener

**FB10**—A powder-actuated driver that will "pin" a pipe hanger to a concrete ceiling or wall in a few seconds has been developed by Mine Safety Appliances Co., Pittsburgh. The small, portable tool embeds studs in steel or masonry by the discharge of a blank cartridge. Once embedded, the studs will hold up to thousands of pounds. Two diameters of studs—⅝ in. and ¼ in.

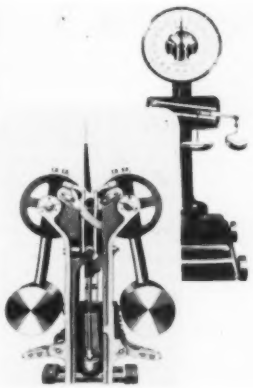
—may be used by interchanging the barrels of the tool. There are several varieties of studs available—externally or internally threaded or plain, headed types. Possibility of accidental discharge is negligible because of rotating safety arm. The powder-actuated driver can also be used to anchor switch and junction boxes to concrete or metal, to stud wood joists or nailing strips to concrete ceilings, and to "shoot" metal window frames into place.

### Dew Point Indicator

**FB11**—An improved instrument for the rapid determination of the dew point of any non-corrosive gas, the Alnor Precision Dew Point Indicator Type 7000 has been developed by Illinois Testing Laboratories, Inc. Relative humidity, grains moisture per lb and latent heat may also be obtained by conversion factors. Indicator is available in two ranges for dew points between -20F and room temperature, and for dew points from -100F to 0-F.

### Dial Scale Mechanism

**FB12**—A basically new dial scale mechanism that achieves straight-line relationship between platform load and pointer without specially filed cams, etc., is announced by the Yale & Towne Mfg. Co.'s Philadelphia Division. Other advantages claimed for the Magnetrol are a reduction of service adjustments from six or seven to only two, and full but light engagement between the pointer rack and pinion by means of a permanent magnet. All moving parts are mounted at three fixed centers in a single gray iron casting. Further, they move on precision ball bearings to minimize internal friction. Capacity of the Magnetrol under direct loading without lever system is 25 lbs; and application to industrial loads up to 50 tons by means



of lever linkage. Guaranteed accuracy is one part in 1000 or more. Dial head contains 20 in. diameter reading-line dial chart, swiveled through 360 degrees.

### Bench Grinder

**FB13**—A ¼ hp, moderately priced electric bench grinder with industrial size grinding wheels, and featuring fully adjustable tool rests with built-in side guides of pre-set angles, is announced by the Speedway Mfg. Co. Housed in cast aluminum, Model 128 operates in 110-120 volt a-c current, at a no-load speed of 3500 rpm. Other features: self-aligning, impregnated oil-less bearings, equipped with 6 ft S-J3 conductor cord and ground wire; 6 amp on-off sliding switch, and rests on rubber grommets to absorb shocks.

*(Continued on Page 81)*

# FOUNDRY Literature

**Readers interested in obtaining additional information on items described in Foundry Literature should send requests to Reader Service, American Foundryman, 222 W. Adams St., Chicago 6, Ill. Refer to the items by means of the convenient code numbers.**

### Copper Base Alloys

**FB101**—An educational manual, "Copper-Base Alloys", recently published by Federated Metals, division of American Smelting and Refining Co., deals with the practical application of copper-base metallurgy. The 52-page booklet includes a compilation of standard industry specification tables, among them those of the ASTM, SAE, AMS, Federal Government and U. S. Navy. Covered in the text are thermal effects, shrinkage porosity, gas porosity, various behavior characteristics of high copper alloys, tin bronzes and red brasses, yellow brasses, manganese bronze, nickel silver, aluminum bronze, silicon bronze and silicon brass. This booklet, accepted by many engineering schools as textbook and library material, is available upon request.

### Zinc Die Castings

**FB102**—A comprehensive report on die casting, the most complete ever published, "Zinc Die Castings in Ever Widening Fields", is available without charge from the New Jersey Zinc Co. Containing 63 pages of photographs depicting the use of zinc die castings in the assembly of 167 different products in 10 major consumer fields, the booklet has 266 photographs in all. Illustrated are applications for household equipment, business machines, hardware, automotive parts, industrial equipment, radio, phonograph and communications equipment, toys, tools, photographic and military equipment.

### Cast Iron Arc Welding

**FB103**—A special issue of the Eutectic Welder, house organ of the Eutectic Welding Alloys Corp., is devoted to the new development of Eutectic in the field of cold cast iron arc welding. The six-page folder contains several illustrated case histories, showing Eutectode 24/49 in actual use in a variety of industries. Flywheels, gas towers, cracked castings, locomotive cylinders and gas engines are completely illustrated, with detailed information on how repairs are accomplished in those particular fields. Also included are numerous technological considerations of the electrode, emphasizing low heat of application, machineability, lack of preheating and tensile strength.

### Magnetic Floor Sweeper

**FB104**—A bulletin describing the new Dings Magna Sweep, for hand sweeping of harmful tramp iron and other magnetic materials from factory aisles, floors, yards, loading docks, foundries and other areas, has just been issued by the Dings Magnetic Separator Co. The bulletin illustrates many applications of the Magna-Sweep, such as cleaning up steel turnings from around machines and separating magnetic from non-magnetic materials, and scrap reclaiming. Features such as light weight, high magnetic pickup power, easy magnet cleaning and no maintenance are explained. The Magna Sweep is available in two sizes, is mounted on rubber-tired wheels, has a mower type handle and finger tip magnet control for easy sweeping. Bulletin B-1307A is free.

### Organosilicon Chemicals

**FB105**—Data and price sheets on four organosilicon chemical compounds produced by the Linde Air Products Co., unit of Union Carbide and Carbon Corp., are available along with two-ounce samples of each for experimentation in the binder compound and pattern protective coating fields. The four organosilicons are ethyltrichlorosilane, amyltrichlorosilane, ethyltriethoxsilane, and amyltriethoxsilane. Silicones, which are produced in limited quantities by Linde's pilot plant, have only recently gained commercial importance in such diverse fields as paint, plastics, electrical insulation, rubber and lubrication. Silicones have been found to possess such qualities as ability to withstand high temperatures and weathering, and make good antifoams, mold release agents and water repellant coatings. Samples and data sheets are offered free of charge to foundries and allied industries for laboratory research into the possible commercial applications of these organosilicons.

### Blasting Nozzles

**FB106**—An attractive, two-color catalog illustrating the complete series of Super-Titan Blasting Nozzles, featuring exclusive tungsten carbide liners and accessories is available from Mills Alloys, Inc. Special booklets have been prepared with tips on the use of blasting nozzles in foundries and other shops. Copies of these booklets and catalog are available on request.

### Drilling Machines

**FB107**—Catalog No. 68, issued by the Sibley Machine & Foundry Corp., describes Sibley Models D-24 and D-28 Drilling Machines. The two-color bulletin lists the improved features of these models, such as the V-belt drive direct from the motor to a 4-speed geared transmission; an "inching" button at the front of the machine which provides ease in changing speeds; and the handy, 4-speed geared transmission lever. Copies of booklet are free.

### Concrete Floors

**FB108**—"Lumnite Concrete Floors—Corrosion Resistant and Heat Resistant", a booklet published by the Lumnite Division of Universal Atlas Cement Co., brings up to date service experiences and late developments in the corrosion-resistant concrete field. Basic information contained in the booklet covers materials and methods and industrial applications. Typical uses of corrosion-resistant concrete are listed for many industries and several questions on placing and finishing the concrete are answered. In addition to the floor applications, this concrete is being used successfully in lining stacks and drainage systems.

### Product Identification

**FB109**—A new catalog, "Portfolio of Artistry in Steel", published by the Metal Marker Mfg. Co., illustrates the importance of proper identification of products as an aid to sales through advertising value, simplicity in reordering, identification of sizes, models, part number and forestalling of unjust legal claims through proper trade marks and patent data. Illustrated are a number of mold inserts, roll dies, steel hobs, punch press and insert stamps built to individual specifications.

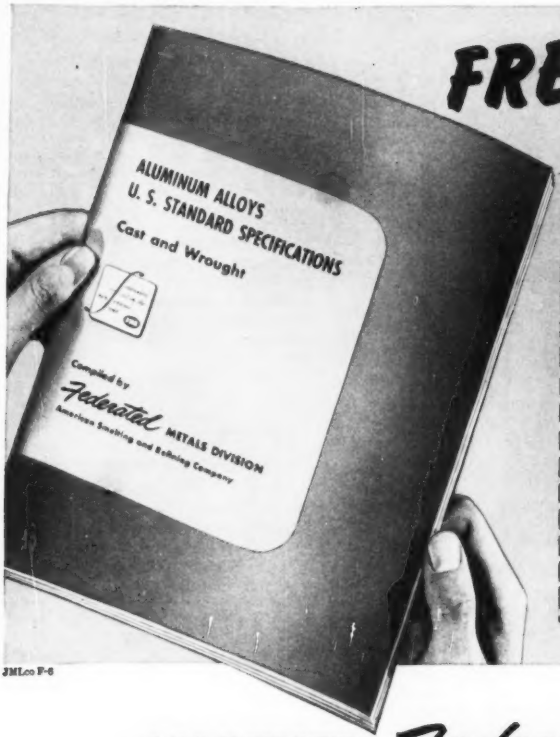
### Electronic Air Filter

**FB110**—American Air Filter Co.'s new Electro PL Model B dry-type electronic air filter is described in the company's recently released Bulletin No. 257. Filtering media, arrangement, power packs, voltage requirement, maintenance, performance characteristics, installation data, capacity and dimension charts, straight bank arrangement charts and "V" arrangement charts are given.

### Grinding Equipment

**FB111**—Portable grinding, high-speed snagging and cut-off operations are described in a new four-page, illustrated

*(Continued on Page 80)*




# FREE Handbook of Aluminum Specifications

Dept. SJ
Federated Metals, division of American Smelting and Refining Company
120 Broadway, New York 5, N. Y.
Please send me a copy of the Aluminum Specifications Hand Book.

My Name _____
Company Name _____
Company Address _____
City _____ Zone _____
State _____

JMLco F-6

## ANOTHER *Federated* FIRST!

For your convenience . . . here in one 24-page volume . . . are all the latest specifications of the aluminum industry—ASTM, AMS, SAE, Federal, Army, Navy and others—as they pertain to Sand Castings, Permanent Mold Castings, Die Castings, Wrought Alloys and Ingots.

This 24-page book is *not* a sales manual. There is no talk in it about the nationwide production, research, and service facilities of Federated which make this company first in the non-ferrous field . . . no facts which prove that Federated's scientific production control and friendly, on-the-spot help with foundry problems mean more satisfactory and profitable products for *you*.

This Aluminum Alloys Specifications manual is a reference book . . . *a must* for your top desk drawer. It's another Federated first . . . another Federated service. Mail the coupon today for your free copy.

Federated Metals produces aluminum alloys of all specifications, as well as copper-base alloys, bearing metals, solders, magnesium alloys, fabricated lead products, zinc dust, deoxidizers and hardeners. 24 offices across the nation.

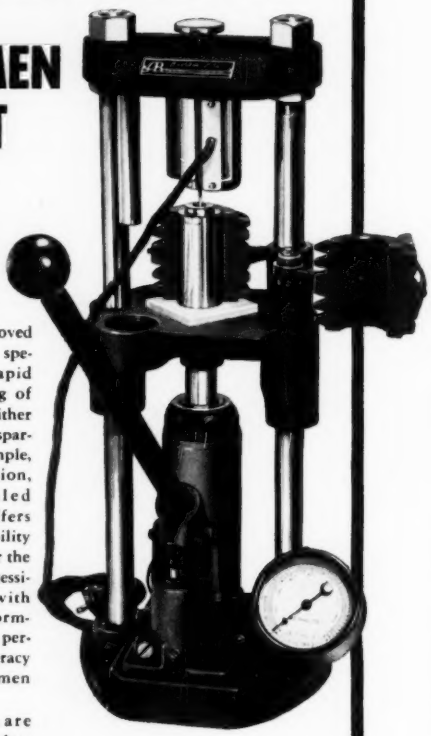
*Federated* METALS

**Division of American Smelting and Refining Company, 120 Broadway, New York 5, N. Y.**

Buehler

SPECIMEN MOUNT PRESS

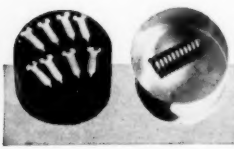
No. 1315



This new, improved model is designed specifically for the rapid precision molding of specimen mounts, either in bakelite or transparent plastic. The simple, rugged construction, without concealed working parts, offers maximum accessibility and convenience for the operator. This accessibility combined with the smooth performance of this press, permits speed and accuracy in molding specimen mounts.

Molding tools are lapped finished for close tolerance with a perfect fit. The fast working solid heater can be raised and the cooling blocks swung into position without releasing pressure on the mold. This rapid cooling permits removal of transoptic mounts in a few minutes. Heater and cooling blocks need not be removed from the press thus eliminating the possibility of accidental burns in handling these parts. This model press will develop pressure up to 10,000 lbs.

THE BUEHLER LINE OF SPECIMEN PREPARATION EQUIPMENT INCLUDES—
CUT-OFF MACHINES • SPECIMEN MOUNT PRESSES • POWER GRINDERS • EMERY PAPER GRINDERS • HAND GRINDERS • BELT SURFACERS • POLISHERS • POLISHING CLOTHS • POLISHING ABRASIVES



Buehler Ltd.
A PARTNERSHIP

METALLURGICAL APPARATUS
165 West Wacker Drive, Chicago 1, Illinois


## LITERATURE

*(Continued from Page 78)*

folder made available by the Sterling Grinding Wheels Division of the Cleveland Quarries Co. Specifications are offered as a general guide to aid in the selection of proper wheels for cut-off, portable and snagging operations. For specific operations, Sterling offers an engineering recommendation to fit local operating conditions.

### Power-House Motors

**FB112**—Allis-Chalmers motors of one hp or larger for driving power house auxiliaries are described in a 28-page illustrated bulletin, which provides data on types and characteristics of induction motors, construction details of standard open-type motors, special features for open-type motors, and totally-enclosed fan-cooled motors. Also included is a handy motor selection chart.

### Pyrometer Controller

**FB113**—A bulletin describing a proportional current-input electronic pyrometer controller is available from the Bristol Co. The bulletin describes the application of the new instrument in proportioning current input to electrically-heated furnaces, ovens, plastic molding machines, salt pots and similar equipment —to provide practically straight-line control. Request Bulletin PB1237.

## FOUNDRY FILMS

### Modern Steam Boilers

**FB110**—"Steam for Power", a 16 millimeter educational film depicting the development and application of modern steam boilers, has been produced by the Babcock & Wilcox Co. This colored sound film is of interest to technical societies, students and civic groups. Making extensive use of both animation and photography, "Steam for Power" traces the important steps in the development of power by means of steam.

As a background, the film shows such early developments as Hero's engine, Branca's turbine and Savery's pumps. Starting with Newcomen's and Watt's contributions, the film outlines the development of boilers step-by-step. In the era of water-tube boilers, "Steam for Power" describes the principles of natural circulation, and with the advent of the electric dynamo and turbine, shows the interplay of developing forces which led to the great power plants of today.

Also shown are the meaning of high steam pressures and temperatures, the application and functions of superheaters, reheaters, economizers, air heaters, and the cyclone steam separator. The development of water-cooled furnaces, pulverized coal firing, slag-top units and the cyclone furnace is depicted.

Concluding sequences of the film show important steps in the manufacture of boiler components and the erection of a large radiant boiler. Film has a running time of 41 minutes and is available free of charge to technical groups, schools and civic organizations.

## NEW PRODUCTS

*(Continued from Page 77)*

### Refractory Material

**FB14**—Leco, a refractory material developed by the Carborundum Co. and now manufactured by Laboratory Equipment Corp., in the form of ignition crucibles, capsules and incinerating dishes will withstand temperatures up to 2600F and has good thermal conductivity. All Leco ware is relatively impervious, has a smooth surface and possesses excellent resistance to shock. Sizes range from crucibles for micro work to rectangular dishes 10 in. by 15 in. high. Principal applications are for ignition of organic and mineral material and general incineration or drying work.

### Safety Clamp

**FB15**—Twistite "C" Cast Clamps, employing a push-pull bar that sets the pressure bar in any position from full open to full closed, have been developed by Richards Industries, Inc., to replace the full-threaded adjustment type of safety clamp. This toolmaker's clamp features a safety roller clutch to prevent frame distortion, a ball-bearing foot that cannot creep or mar material and prevents twisting, a cast deepthroat frame available in malleable or heat-treated aluminum in 2 to 6 in. or larger sizes, spatter-resistant rod and frame and a pressure unit for use in jigs and fixtures.

### Automatic Filters

**FB16**—M-B Products' Automatic Air Line Filter features a transparent plastic bowl, making the filtering element and such foreign matter as water, oil, scale, and dirt clearly visible at all times during operation. This plastic material withstands temperatures up to 150F and a burst test of 500 lb. Ribbon type filtering element functions on the edge filtration principle and positively removes solids 10 microns and larger. Dirt can be removed from edges of filtering element by removing vent plug from head and opening drain cock, then blowing out with air nozzle. Base and bowl can be taken out by removal of one nut, as can the filtering element. Automatic Air Line Filter is used as an accessory to any machine or piece of equipment and comes in ½, ⅝ and ¾ pint bowl capacities.

### Improved Payloader

**FB17**—Important improvements in the Frank G. Hough Co.'s Model HA 10½ cu ft and Model HL 1¼ cu yd Payloaders feature the addition of hydraulic bucket control as standard equipment. This control dumps and closes the bucket by hydraulic power. Bucket can be dumped gradually or abruptly as desired by fingertip control and can be closed immediately by the same control. Advantages of this feature are ease and speed of operation because the bucket need not be grounded and dragged to close it, trucks are relieved of load-dumping shock, wear and tear. Portions of the bucket load can be deposited in two or more places.


TEPCO

FERRO-SILICON
*BRIQUETTES*

Tepco Ferro-Silicon Briquettes, used mainly for the addition of silicon to the cupola charge of iron foundries, are most convenient because they contain a certain definite weight and can be counted instead of weighed. At the same time, the briquettes are more valuable than lump ferro-silicon because the binder in the briquettes protects the ferro-silicon as it is melted in the cupola and a greater return of silicon is obtained by that means.

Tepco Ferro-Silicon Briquettes are produced at our Chattanooga plant (formerly Southern Ferro-Alloys Company, Chattanooga, Tennessee). The 2½-pound briquettes contain one pound of silicon and the 5-pound briquettes contain two pounds of silicon.

Tepco Ferro-Silicon is also available in all sizes from lump through 150 mesh by down, packaged or in bulk—50%, 65%, and 75% standard and low impurity grades. Special grades and sizes quoted on request.

PIG IRON

Tepco's high-grade pig iron includes two preferred types:

Diamond D Pig Iron—low-phosphorus, low-silicon, high-carbon, machine cast—produced at our Wrigley Charcoal Plant at Wrigley, Tennessee.

Rockwood Pig Iron—malleable and foundry, machine cast, produced at our Rockwood, Tennessee, plant.

Tepco production of both ferro-silicon and pig iron is completely integrated. High-grade coking coal is produced in our own mines and processed in company-owned by-product coke ovens at Chattanooga. Foundry and blast furnace coke is produced from properly blended coals, all by-products recovered and converted to chemicals which are widely used in industry.

We will be glad to discuss with you, at any time, the numerous advantages of our plants and products.

TENNESSEE PRODUCTS & CHEMICAL CORPORATION

GENERAL OFFICES: NASHVILLE, TENNESSEE

PLANTS AT CHATTANOOGA, ROCKWOOD AND WRIGLEY, TENN.

Represented by

MILLER & CO., Chicago, St. Louis, Cincinnati; E. H. BELL CO., Pittsburgh; T. H. BENNERS & CO., Birmingham

## PERSONALITIES

*(Continued from Page 67)*

Denver, Colo., in 1900 at the age of 15 as an office boy. He later served successively in the operating and sales divisions in various cities throughout the country prior to his appointment as vice president and director in 1945. Mr. Waud first joined Griffin Wheel in 1905, also at Denver, and served in various capacities prior to his election as president of the company in 1937. He has been elected chairman of the Executive Committee and will remain a director of the company.

**William M. Barron,** a recent graduate of the Carnegie Institute of Technology, has joined the American Brake Shoe Co., Mahwah, N. J., as a metallurgist and has joined Metropolitan Chapter of A.F.S.

**Dr. Frank B. Jewett,** formerly chairman of the board of the Bell Telephone Laboratories, and formerly president of the National Academy of Sciences, has accepted an appointment as a member of the board of trustees of Battelle Memorial Institute, Columbus, Ohio. An outstanding leader in research, Dr. Jewett was associated with the American Telephone & Telegraph Co., and the Western Electric Co., in engineering during the period of greatest technological development in communications. He has served as vice-chairman of the board of the Engineering Foundation and as chairman of the Division of Engineering and Industry of the National Research Council.

**Henri Perchat,** head of the foundry and forge technical service department of France's Renault industries and Jean Huson, forge manager, were recent visitors to A.F.S. Headquarters.

**Henry E. Trimble,** for 22 years a member of the foundry industry, has accepted a position as assistant foundry production manager for the United Conveyor Corp., and will supervise production of United Conveyor castings made at the Sibley Machine & Foundry Co., South Bend, Ind. Mr. Trimble attended Maryland University, where he studied metallurgy, and following this, in 1922, worked for a Kansas City, Mo., foundry for 10 years. For four years he operated his own foundry business, and for seven years was in the employ of the Navy Department, five of which were spent as foundry manager of the Naval Ammunition Depot at Crane, Ind.

**James J. Nelson,** formerly sales representative, has been appointed Eastern sales manager of the National Bearing Division of the American Brake Shoe Co., according to an announcement by T. W. Pettus, Division president. Prior to joining Brake Shoe, Mr. Nelson served as a divisional vice-president of the Baldwin Locomotive Works. He is a member of the United States Naval Engineers and the Society of Naval Architects and Marine Engineers.

**Maynard B. Terry,** formerly general sales manager of the American Brakeblok Division of the American Brake Shoe Co., was recently appointed vice-president of the Division. Mr. Terry, who has been with Brake Shoe in various sales capacities since 1943, will continue to be located at Division headquarters in Detroit.

**B. I. Whiting,** a director of the A.F.S. Northern Illinois-Southern Wisconsin chapter, resigned recently as chief engineer of the Woodmanse Manufacturing Co., Freeport, Ill., to open his own consulting engineering practice in that city.

**Jerry M. Zilka,** formerly a member of the A.F.S. Student Chapter at the Massachusetts Institute of Technology, recently accepted a position with Gunite Foundries Corp., Rockford, Ill., and has joined the Northern Illinois-Southern Wisconsin chapter of A.F.S.

**Cecil E. Gorman** of MacDonald Metals & Plastics, Ltd., has been appointed works manager of S. Vessot Co., Ltd., Joliette, Que., Canada.

**Jack R. Koske** has been appointed to Eutectic Welding Alloys Corp.'s board of regional sales supervisors. A onetime Eutectic field engineer, Mr. Koske operated his own auto and implement repair shop and was a contractor and excavator. Dur-

*(Continued on Page 88)*

THE TEST THAT PROVES IT BEST!
Buckeye Silica Firestone Lining
27"
24½
48"
54"
Buckeye Silica Firestone is the best refractory for lining cupolas . . . the above test is one of many that prove it!
The diagram shows a test that was made by a large foundry to compare the refractory efficiency of Buckeye Silica Firestone with the manufactured material this foundry had used for years.
One-half of the melting zone of the cupola was lined with Buckeye Silica Firestone, the other half with the other material. Under identical conditions, the Buckeye Silica Firestone burned only to a depth of three inches while the daily patch of the other material burned completely through as well as one inch of the backing next to the shell.
Next time, line your cupola with Buckeye Silica Firestone . . . its simplicity of use, superior refractory qualities, longer life, and definite contribution to scientific cupola control have influenced foundries all over the country to adopt it as standard.
Your requirements can quickly be determined by our service department. No obligation. Write today.
THE CLEVELAND QUARRIES COMPANY
1740 E. Twelfth St., Cleveland 14, Ohio
BUCKEYE SILICA FIRESTONE
BUCKEYE
"FOR THAT EXTRA SERVICE"
SILICA FIRESTONE

V40F

473

# IT'S ALL IN KNOWING HOW!

## -IN JUGGLING OR BALANCING CORE OILS

V50F

Unlimited
technical resources
and endless experiment have fashioned
Velsicol's balanced core oils
for every core making problem

V35T

V45G

V38G

**CORE OILS for**

- Clean — clay free open sand
- Sand containing fines and clay
- Castings susceptible to hot tears and difficult core removal
- Castings requiring cores with high hot strength
- Light sectioned castings
  Heavy sectioned castings
- Iron or steel castings
  Non ferrous castings

# VELSICOL Corporation

**General Offices: 330 East Grand Avenue, Chicago 11, Illinois**

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Chattanooga, Tennessee

F. F. Pearles
18453 Westover Blvd.
Detroit 19, Michigan

The Foundry Supply Co., Inc.
404 South Third Street
Minneapolis, Minnesota

General Foundry Service Corp.
516 23rd Avenue
Oakland, California

Stoller Chemical Co.
31 No. Summit St.
Akron, Ohio

The Trabon Co.
122 S. Michigan Ave.
Chicago 3, Illinois

# FOUNDRY FIRM *Facts*

**Buckeye Products Co.,** Cincinnati manufacturers of foundry facings, supplies and equipment, will observe its 40th anniversary this year. During that period the company has had three locations in Cincinnati, and is now situated in its own modern building, where it manufactures Avon, Clifton and Buckeye parting compounds, Linseal core oils, "3-in-1" flask guides, Buckeye High temperature furnace cement and Econocore core compound.

**Lancaster Malleable and Steel Corp.,** Lancaster, N. Y., manufacturer of malleable iron castings, has adopted a group insurance program as a mutual undertaking between company and employees, which provides for weekly sickness and accident benefits, accidental death and dismemberment coverage, and for hospital expense and surgical operation insurance and visiting nurse service.

**Staveley Coal & Iron Co., Ltd.,** Chesterfield, England, has incorporated its iron, chemical and engineering departments into a subsidiary company, the **Staveley Iron & Chemical Co., Ltd.,** which will be located at Chesterfield.

*New officers and directors of the Kirk & Blum Mfg. Co., Cincinnati, elected at a Directors' Meeting November 10 are, seated left to right, F. G. Weber, assistant secretary treasurer; O. F. Tenoever, treasurer; W. R. Meuttman, vice president; R. J. Blum, Jr., president; C. F. Wulff, vice-president; E. A. Vogel, secretary; F. A. Zink, director. Standing in the back row are other executives of the company, left to right, R. W. New, Joseph A. Fries, R. B. Werner, C. S. Furman, Joseph Hetzer, C. S. Hulton, John Hetzer, S. L. Cox, M. G. Stock, E. A. Carsey, E. W. Thiery.*

**The Foundry Equipment Co.,** Cleveland, has purchased, as part of its expansion program, **Young Brothers Co.,** Detroit industrial oven manufacturers, it is announced by Charles A. Barnett, president of the Foundry Equipment Co. Organized in 1896, Young Brothers is one of the nation's leading manufacturers of industrial ovens for paint and varnish baking, lithographing, metal decorating, chemical drying, textile, rubber and other processing. The Foundry Equipment Co., also one of the oldest firms in the industrial oven field, specializes in the design and manufacture of ovens for foundry service, particularly for core baking, mold drying and heat treating. Young Brothers Co. will be operated under that name.

*George Feyh (left) oldest employee of the Hamilton Foundry & Machine Co., Hamilton, Ohio, receives a Christmas food basket and 50 silver dollars from President Peter E. Rentschler as Santa Claus and Vice-President Donald McDaniel look on at the company's Christmas party. Employees received bonuses commensurate with their length of service with the company, and in addition, received food baskets and dressed fowls.*

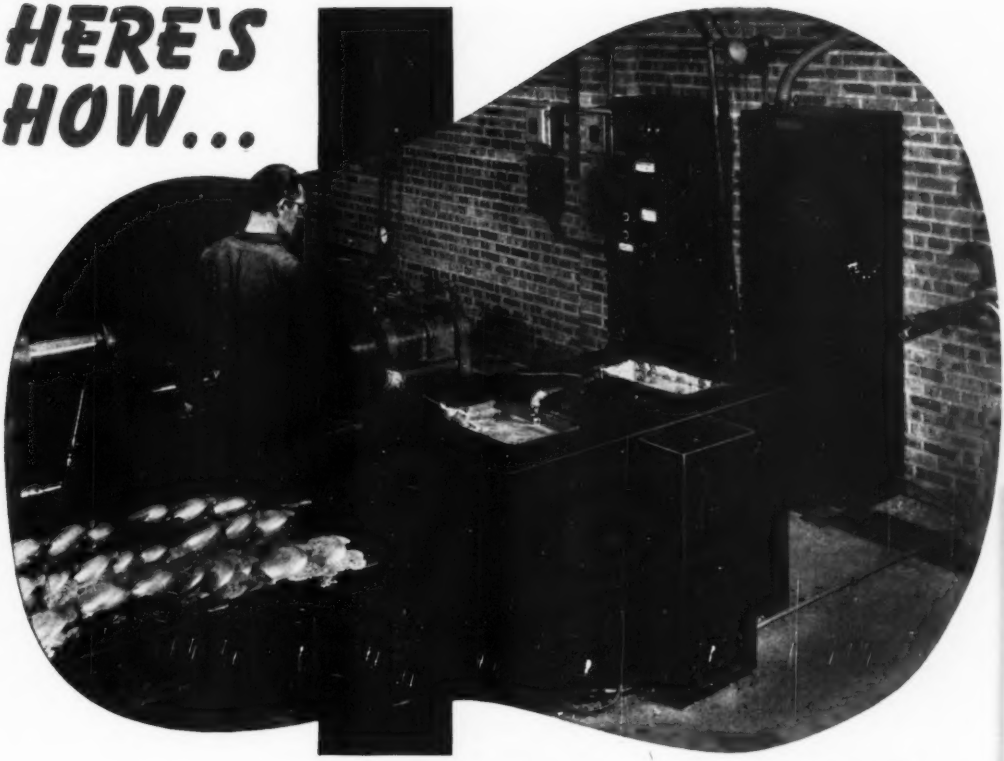
**National Bronze Works Co.,** St. Louis, recently changed its corporate name to **Rexite Casting Co.,** and will continue to produce aluminum permanent mold, brass, and aluminum sand castings at the same location, 4535 Pope Ave., St. Louis, 15.

**Canadian Car & Foundry Co., Ltd.,** recently held three banquets honoring its employees. The first was given by President V. M. Drury in tribute to the Cancar Soccer Club, winners of the Canadian Challenge Trophy, the Quebec championship, the National League championship (Eastern Section), and the Lord Atholstan Trophy. Other banquets honored the Quarter Century Club members of the Montreal and Brantford plants.

**ABC Coal & Coke Co.,** Birmingham, Ala., wholly-owned sales subsidiary of the **Alabama By-Products Corp.,** Birmingham, was recently merged into the parent company as part of a move to simplify the corporate structure. All commitments, contractual and otherwise, will be assumed by Alabama By-Products Corp. The move does not affect sales or personnel.

*(Continued on Page 86)*

# HERE'S HOW...



★ **Casting rejects are reduced 43% . . .**
★ **Production Increased 22% . . .**
★ **Per Unit Labor Cost cut 24% . . .**
*at Reed Metal Crafts, Chicago*

Roe F. Reed, President, Reed Metal Crafts and prominent in die casting circles says: "We're more than satisfied with our Lindberg-Fisher melting furnace. We've ordered another, and plan to install more in the future".

**A Lindberg-Fisher 2-chamber induction melting furnace** was recently installed by this well known Chicago custom die casting plant. They report reduced rejects and increased production because . . .

. . . **there is no alloy segregation** and thus no rejects due to machining difficulty resulting from segregate-inclusions. Alloys are *kept* in solution and effectiveness of alloy content is *not* lost.

. . . **molten aluminum temperature uniformity is held to plus or minus 5°F.** Castings can be shot at lower temperatures because there is no need to allow for furnace over-and undershooting. Lower casting temperature permits more shots per hour—increases production—reduces rejects.

. . . **ladling is continuous.** Ingot or scrap is charged into *separate* chamber—melts and flows into ladling chamber. No lost stand-by time while aluminum melts.

. . . **only metal is heated,** not the entire furnace. Reduced heat radiation from furnace shell lowers temperature 20°–25° F. at operator's station—improves working conditions.

Ask for reprint of magazine article "Two-Chamber Induction Melting Furnace Lowers Aluminum Die Casting Cost".

*Fisher Furnaces*

**A DIVISION OF LINDBERG ENGINEERING CO.**
**2440 West Hubbard Street, Chicago 12, Illinois**

**OTTAWA SILICA CO.** *offers...*

**WASHED**
**DRIED**
**SCREENED**
**GRADED**
**WHITE SANDS**

Our specially prepared SILICA SANDS are available in various sizes. We have the particular grade best suited for your requirements. ¶ You will find our SANDS most suitable for cores —they save oil—they are clean, uniform and constant in quality. ¶ SILICA FLOUR, at its best, for foundry uses.

**OTTAWA SILICA COMPANY**
Ottawa, Illinois

## FIRM FACTS

*(Continued from Page 84)*

**Monsanto Chemical Co's** English subsidiary, **Monsanto Chemicals, Ltd.,** has purchased control of **Silicon (Organic) Developments, Ltd.,** Bridgend, Glamorgan, England. The newly-acquired company is a small organization specializing in the manufacture of silicon chemicals. One of its products, Silester, is used in the precision casting of turbine blades for jet propulsion power units. The product is also used as a waterproofing compound for cement, brick and stone walls.

The 100th Anniversary of the **American Locomotive Co.,** was recently observed in Schenectady, N.Y. In commemoration of the event, company officials presented the City of Schenectady with a 110-foot flagpole honoring the city's war dead. The company was host at a day-long open house to employees and their families, when models of early locomotives built by the company, and its currently-built diesel electric locomotives were placed on display.

**Clipper Mfg. Co.,** Kansas City, Mo., will open a new Western Divisional Branch Office at 422 Market St., San Francisco. The new factory warehouse and office will carry a complete stock of Clipper saws, blades, abrasives and portable hoists for immediate shipment to any point on the West Coast.

**Belle City Malleable Iron Co.'s** handbook of information for employees, "Things You Need to Know About Your Job," is issued to every employee of the company and tells the history of the company, describes its spirit of cooperation, and the many advantages its workers have, such as group insurance, social and recreational activities, credit and welfare services. In addition, the booklet serves as a handy pocket guide to help the new worker in orienting himself.

In a single shift, 75 foundrymen produce 20 to 30 tons of gray iron castings daily in the recently mechanized foundry of the **East Springfield (Massachusetts) Works, Westinghouse Electric Corp.** Ranging in size from ½ to 40 lb, the castings are used in the manufacture of electrical appliances in the 5000-employee Works.

Entire cost of the modernization program was $1,250,000. Of steel, brick, and sash construction, the foundry building is 180 ft wide, 256 ft long, and has 46,890 sq ft of useable floor space. Three 50-ft high bays and five 24-ft low bays give a total of 1,472,000 cu ft of space. Seventy per cent of the side walls is in windows.

In mechanizing the foundry for high production of small castings, special thought was given to elimination of manual labor and to heating and ventilating to provide the best possible working conditions. Mechanization has reduced the amount of material handled per day by the 75 foundry employees from 1470 tons to 294 tons. Heating and ventilating equipment includes unit and curtain heaters, fan-driven roof ventilators, dry dust and wet

*(Continued on Page 90)*

# SCOPE OF SERVICES
# IN BASIC FOUNDRY ENGINEERING

We are professional engineering consultants on matters pertaining to the physical activities and mechanical processes in the manufacture of castings with a background of more than twenty years in this work.

We are designers of new plants and of the necessary facilities to modernize existing plants.

We have advanced some of the newest designs in foundry equipment and will steadily improve these techniques.

We supply complete construction and detailed drawings of equipment, structures, electrical systems, etc., with full specifications and material schedules.

We have no associations which could be prejudicial to ethical conduct of all engineering phases of any project. This assures an undivided responsibility to our clients and the best results at the least capital outlay.

A preliminary conference on the question of initiating improvements or new projects incurs no obligation.

## FRANK D. CAMPBELL

*Consulting Engineers*

**SERVING THE FOUNDRY INDUSTRY**

332 SOUTH MICHIGAN AVE. WAbash 2-3479 CHICAGO 4, ILLINOIS

"Most for the Money" with CRUCIBLE furnaces

Raising prices builds up sales resistance. Make your profits by economies in the foundry.

Avoid heavy capital investments by installing Crucible Furnaces. The lowest installation cost, the surest satisfaction, and the most economical service is found only in Crucible Furnaces. Every way you take it Crucible Furnaces mean most for your money.

Our advice is before (not after) you decide on your non-ferrous melting equipment, consult a Crucible furnace manufacturer. Ask for Crucible Melters' Handbook—a handy little volume that should be in the the hands of every melter.

CRUCIBLE MANUFACTURERS ASSOCIATION

140 CEDAR STREET
NEW YORK 6, N.Y.

## PERSONALITIES

*(Continued from Page 82)*

ing the war he served as aircraft test engineering foreman and instructor. Mr. Koske will supervise Eutectic's sales in the East Central section of the United States. It was simultaneously announced that **Paul E. Miller** will supervise sales in the Mid East territory. He formerly managed an upholstery and body shop for a Midwestern motor company, and, more recently, has been Eutectic sales engineer.

**S. DeVries** has been appointed Connecticut representative for the George Haiss Mfg. Co., Inc., New York materials handling division of Pettibone-Mulliken Corp., Chicago. Mr. DeVries' business address will be Post Office Box 31, Milldale, Conn.

**Robert S. Bowie** will head the new Chicago branch office of the Cooper-Bessemer Corp., located at 122 S. Michigan Ave. The Chicago office will be under the direction of **Charles L. White,** North Central area district manager.

**Roland C. Disney,** assistant to the vice-president, Eddystone Division, Baldwin Locomotive Works, has been appointed vice-president and general manager of the Whitcomb Locomotive Co., a Baldwin Locomotive Co. subsidiary.

## OBITUARIES

**William A. Engelhart,** salvage engineer for the Pontiac Motor Division, General Motors Corp., died November 19 of a heart ailment while being taken to his home by fellow workers after collapsing at work. Mr. Engelhart attended Purdue University and prior to joining Pontiac had been car service manager for General Motors Corporation in Indianapolis for 12 years, sales manager for Manville Mfg. Co., Pontiac, Mich., for three years, and for five years was in private business as a sales promotion specialist. Joining Pontiac in 1941, Mr. Engelhart was in the purchasing contact department, then the inspection department, and in 1946 was placed in charge of salvage operations where he perfected a method for making coke briquets. An article written by Mr. Engelhart in collaboration H. W. Arterburn on this subject appeared in the November, 1948, issue of AMERICAN FOUNDRYMAN.

**J. A. Crew,** 60, retired vice-president of the Avers Mineral Co., Zanesville, Ohio, died December 31 in a Zanesville hospital. A graduate of the Ohio State University School of Mining and Metallurgy, Mr. Crew became chief metallurgist of the Illinois Steel Co., Gary, Ind., in 1911, and in 1919 accepted a similar position with the Pittsburgh Steel Co., Monesen, Pa. Mr. Crew joined Avers Mineral Co., in 1922, and in 1943 was appointed vice-president in charge of operations of the company's Glass Rock, Millwood and Blissfield, Ohio, and Lexington, Tenn., plants. He retired from active duty in June, 1948, because of ill health.

# ABSTRACTS OF TECHNICAL ARTICLES

### Brass and Bronze

MELTING. Georges Blanc, "Degasification of Bronzes and Brasses" (Le Degazage des Bronzes et Laitons"), *Fonderie*, July, 1948, no. 31, pp. 1236-1241.

In a previous article the author reviewed the literature on gas in copper and its alloys and concluded that reducing gases were most often responsible for porosity in copper alloy castings. Most common offenders are hydrogen, and carbon monoxide, but the combination of reducing elements with oxygen to form, for example, water vapor or sulphur dioxide also can cause porosity.

The article contains the proposed procedures to eliminate gas and to combat its harmfulness. The procedures for degasification described are: (1) Degasification by vacuum, (2) Oxidation by oxygen from the air, (3) Use of flux deoxidants, (4) Bubbling with inert gas, and (5) Solidification and remelting.

### De-Sulphurizing

PIG IRON. W. C. Newell, A. J. Langer, and J. W. Parsons, "New Methods of Ladle De-Sulphurizing Pig Iron," *Foundry Trade Journal*, vol. 85, no. 1668, August 19, 1948, pp. 165-172.

The Steel Castings Division of the British Iron and Steel Research Association reported on recent theoretical and practical investigations of new and improved methods of desulphurizing remelted iron for iron and steel foundries.

Increasing demand for steel of lower sulphur content and the shortage of suitable low-sulphur pig iron and steel scrap raised the importance of the desulphurization process.

The object of the investigation was to devise a process whereby sulphur content of molten iron in a ladle could be reduced to the desired limit in an easy manner without the objectionable fumes.

Experiments confirmed that basic and reducing conditions are favorable for desulphurization. Basic slag made fluid by spar addition and bubbled with nitrogen was found to be favorable. It was found that desulphurization does not increase with rise in basicity or that its extent is not necessarily proportional to the CO removal. In a low degree of desulphurization it was found that the percentage of sulphur loss is closely proportional to the sulphur distribution factor between slag and metal, but for higher degrees of desulphurization the divergence increases rapidly. Theoretically the sulphur distribution factor is more significant than the percentage of sulphur loss.

The mechanism of desulphurization process is essentially the mutual exchange of sulphur for oxygen between two metals so that the important specific elemental property which must be considered is the free energy change from oxide to sulphide.

It is observable in the table showing relative desulphurizing power of various elements that the desulphurizing tendency would progressively increase with atomic weight in that series. Barium was selected as best because of its atomic weight and low cost for the experiments. These confirmed that some sulphur dioxide passes into the atmosphere according to the chain of reactions: Sulphide, Sulphate, Gaseous $SO_2$. A very stable sulphate would mean that the sulphide concentration in the slag would be lowered at the slag/gas interface. An unstable sulphate might lead to the ready transfer of sulphur as $SO_2$ to the atmosphere, aiding desulphurization. From available data it appears that with the reducing conditions prevailing in contact with molten iron, very little sulphide would be oxidized to sulphate and that under oxidizing conditions of atmospheric air, an appreciable amount of any sulphide would be oxidized and dissociated, liberating $SO_2$. Thus, for optimum desulphurizing, the somewhat conflicting requirements are reducing conditions at the slag/metal interface and oxidizing conditions at the slag/air interface.

*(Continued on Page 91)*


Brief Notes for Busy Foundrymen

Use of Southern Bentonite in MALLEABLE . . .

Malleable iron probably is subject to cracks and hot tears more than any other metal. Every precaution must be taken to avoid these defects as the castings cannot be reclaimed by repair.

PANTHER CREEK Southern Bentonite has saved many malleable castings of peculiar shape and design by permitting the use of a green sand core with good collapsibility and sufficient flowability to form the character outlines of the pattern.

Since malleable iron must be allowed to cool slowly, the best bonding agent to use is one that does not bake with a hard shell when the heat radiates through the mold. Once the metal begins to solidify and contract, the contraction of the metal very easily deforms the core, and the sand pours from the deep pockets and recesses leaving behind a flawless clean surface.

The many odd shapes demanded of malleable castings by the commercial market, and the smooth finish strived for, again brings out the importance of selecting a bonding agent offering the greatest flowability. No other bond has the characteristic of flowing into pockets, over the bosses, or around the curved areas as PANTHER CREEK. Under mechanized operations, much time is lost at the molders machine by "tucking-in" or "butting" molding sand into place. Time study men always frown upon any unnecessary operations and those who have measured the savings when PANTHER CREEK is employed look upon it favorably and recommend it most highly.

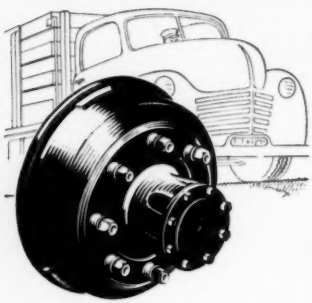
"Economy in the Foundry"

*is a new bulletin containing valuable data on the use of Southern Bentonite. Your copy is available without charge from your supplier.*

VOLCLAY Western Bentonite • FIVE STAR Wood Flour • PANTHER CREEK Southern Bentonite

AMERICAN COLLOID COMPANY Chicago Illinois • Producers Since 1927

Available from Leading Foundry Suppliers in the United States and Canada



## Wear- and heat-resistance —together

**The addition of Molybdenum to cast iron has specially applicable effects where good resistance to wear must be combined with least susceptibility to cracking under sudden changes of temperature.**

**Brake drums, for instance: here is a well-proved composition, 3.70% Total Carbon, 1.80% Silicon, 0.80% Manganese, with 0.50% Chromium and 0.70% Molybdenum added.**

**This is one of the many suitable economical compositions in our new booklet, "Applications of Molybdenum Cast Irons." The busy foundryman and engineer will find the alphabetical listing useful—write for a copy!**

**Climax Molybdenum Company**
**500 Fifth Avenue**
**New York City**

Please send your FREE BOOKLET "Applications of Molybdenum Cast Irons"

Name.....

Company.....

Address.....

MOLY

AF2 F 11


## FIRM FACTS

*(Continued from Page 86)*

dust collectors. Every hour there are 8.1 complete changes of air in the foundry.

An overhead conveyor carries shakeout sand, after screening and magnetic separation, to a 250-ton hot sand storage bin. Belt conveyors carry sand from mixer to aerator and then to hoppers above the various molding stations. Under-the-floor rubber conveyor belts return spilled sand from the molding machines. Shakeouts discharge castings and hot sand onto an oscillating under-the-floor conveyor that carries both to a vibrating perforated separator.

Castings travel from the separator on a 600 ft long trolley conveyor around the outside of the building to an area adjacent to cupola charging operations. Castings are loaded automatically and carried on 2 x 4 ft trays. The conveyor allows the castings to cool outside the building and takes them to the sorting area.

Molding, mold handling, pouring and shakeout are on a high production basis throughout the plant although there are a few conventional molding units for handling short orders on miscellaneous parts. The center bay of the foundry contains the motor housing molding unit which is essentially automatic except for handling of flask sections and closing the mold. After positioning the empty drag or cope on the molding machine by air hoist, sand is added from an overhead hopper through an air-operated gate. The machine automatically jolts, squeezes, turns the drag over, vibrates and draws the pattern. On the cope, automatic operations include striking excess sand and stripping the pattern.

After molding the drag is pushed through the machine onto a roll conveyor. The completed cope is picked up by the molder with an air hoist and placed on the drag, the entire mold then moving on the roll conveyor to an air-operated transfer car. This moves the mold to the pouring line where air-operated clamping plates hold the cope down while the molds are poured from 1000-lb insulated ladles on tram-rails.

After pouring, the shakeout operator picks up the mold with an electrified jib crane equipped with a special lifting and roll-over yoke. After discharging casting and sand over a ventilated vibrating shakeout, the empty flask is placed on a ramp leading to a gravity roll conveyor. An air piston pushes the mold onto the conveyor for return to the molder.

The small automatic molding unit makes cope and drag in one operation, uses a three deck conveyor to conserve floor space, and ends with a unique shakeout. As a mold comes off the line it rolls into a basket supported on trunnions slightly off center. The weight of the mold turns the basket over and hot sand and castings are discharged onto the oscillating conveyor. An air piston automatically raises the basket vertically to the upper deck of the conveyor where the empty flask unloads for return to the molder. No bottom boards are used, the drags being fitted with grids to keep the sand in the flask.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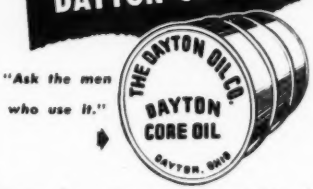


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## ABSTRACTS

*(Continued from Page 89)*

These conditions prevail in the static state. The authors sought to transfer the sulphide up through the slag by bubbling an inert or reducing gas ($N_2$ or $NH_3$) through the bath in such quantity to make the slag/air interface a reducing one.

In their experimental procedure a small high frequency laboratory furnace with a basic crucible, and a basic lined ladle were used. Some power was necessary to maintain the desired temperature and this produced a swirling movement in the bath. It was found that slags were less basic than the slagmaking additions.

In one group of experiments nitrogen or ammonia was bubbled through the slag which was kept fluid and basic by additions of various materials such as fluorspar and alumina.

In a second set of experiments various additions were made to the molten metal with the express object of revealing any specific desulphurizing effects.

Experiments with nitrogen showed that sulphur removal was not proportional to the volume of nitrogen. Bubbling of nitrogen caused a temperature drop.

Barium carbonate additions showed little beneficial action since the carbonate only partly dissociated at the experimental temperature, and the liberation of carbon dioxide from it had an unfavorable oxidizing influence.

Outstanding results were achieved with calcium nitride. A violent liberation of gas occurred when it was added with equal parts of limestone.

### Gas Porosity

NICKEL-SILVER ALLOYS. T. F. Pearson, W. A. Baker, and F. C. Child, "Gas Porosity in Nickel Silver Castings," *Foundry Trade Journal*, vol. 85, no. 1667, Aug. 12, 1948, pp. 145-152.

Small scale melting and casting experiments were conducted on cast nickel silvers exhibiting gross gas unsoundness.

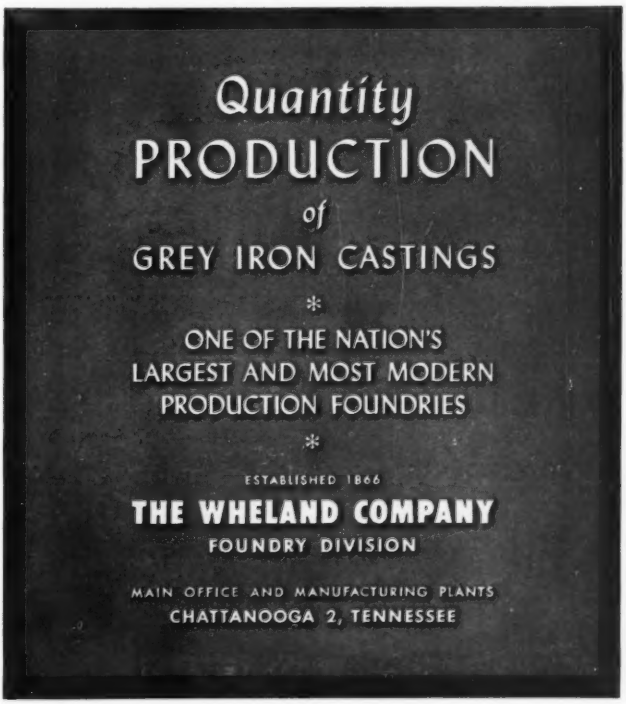
Papers on these alloys seem to agree that melting in strongly oxidizing conditions, followed by deoxidation, in some cases with several deoxidants added in succession, yields satisfactory results.

An alloy containing 60 per cent copper, 20 per cent nickel, and 20 per cent zinc was selected as a typical alloy and findings obtained would be applicable to nickel-silvers in general. Melts were prepared from high-purity commercial materials.

Experiments were conducted in a high frequency tube furnace, high frequency open crucible, and a gas fired furnace. Results are consistent with practical experience in showing that nickel silvers yield consistently sound castings when melted under strongly oxidizing conditions. Melting under reducing conditions is liable to result in gas unsoundness. Deoxidation with manganese, phosphorus, or magnesium suppresses the gas unsoundness, even if the melting conditions are unfavorable.

The laboratory experiments also show that nickel silvers are not seriously subject to hydrogen gas unsoundness.

The gas unsoundness is attributed to



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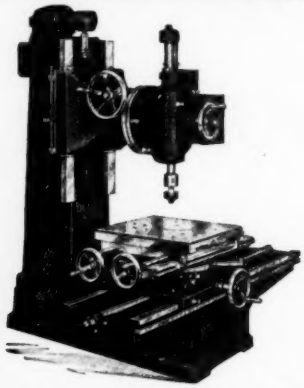

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the evolution of carbon monoxide during solidification and the evidence indicates that carbon and oxygen dissolve in the melt, giving rise to gas porosity only when their concentrations are at some critical value. The oxygen content is small in view of the presence in the alloys of 20 per cent or more of zinc.

It is expected that powerful deoxidants will be required to reduce the oxygen content below the critical value.

It is recommended that nickel silvers be melted under strongly oxidizing conditions, e.g., by exposing the molten alloy to air or by suitably controlling the fuel-air ratio, or by the inclusion of oxidants, such as, manganese ore, etc., in the furnace charge. Charcoal covers should never be used. In strongly oxidizing melting conditions, deoxidation is not essential, but is recommended as a safety measure.

### Cast Iron

WELDING REPAIR. H. B. Gilson, "Bronze Welding or Fusion Welding for Repairing Cast Iron," *Materials & Methods*, vol. 28, no. 3, Sept., 1948, pp. 74-76.

A casting is not melted in bronze welding. It usually is heated to about 600-800 F while the metal along the line of the weld is heated to about 1000 F.

The base metal is melted in fusion welding. The beveled edges melt and the vee is filled in with molten metal from a cast iron welding rod. A high temperature, about 2200 F, is needed to melt the casting along the line of the weld. For this reason the casting is usually preheated to 1000-1200 F. This prevents setting up stresses that might crack the casting later. In fusion welding the casting is actually recast in the welding groove.

In either type of welding the joints are prepared by beveling the edges to form a 90 degree vee. Cooling procedure is the same for both. Large parts are covered with asbestos paper as a protection against draft, while the small ones are buried in dry sand, slaked lime, dry asbestos cement, or some other insulating material.

The type of cast iron determines the proper welding method. Fusion welding may be used for white iron but is not satisfactory since the part loses its wear resistance at the weld.

Either fusion or bronze welding may be used on gray iron casting. Color match and the temperature at which the part will be used influence the choice.

Malleable iron is always bronze welded since fusion welding would destroy its malleability.

If parts are to be operated at temperatures under 500 F, either type of welding may be used. Bronze loses strength at temperatures over 500 F so only fusion welding is used then.

If color match is important in a gray iron casting fusion welding must be used. Repairing of "poisoned" castings is best done by fusion welding.

Fusion welding is preferable if the weld is to be machined, tapped, or threaded and also if the casting is to be enameled or glass-coated. Bronze welding is best if gear teeth have to be rebuilt or reshaped.

In fusion welding the entire part should be preheated in a furnace.

## BOOK REVIEW

*Metals Handbook*, 1948 Edition. Published by the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio. xi, 144 pp.

The *Metals Handbook* is about 40 per cent larger than the last (1939) edition. The key to the information is in the general index or one of the six other guides or tables of contents.

The most complete information is given under the metal or alloy entry but there are references to the various processes and properties in the index.

Nonferrous alloys are listed under their common name and also under their components with the base metal given first. This is also done in the case of the numerical trade designations.

New articles of interest to foundrymen are: "Precision Casting," "Slush Casting," "Production of Finished and Semi-Finished Aluminum Alloy Castings," "Production of Finished or Semi-Finished Copper Alloy Castings," "Melting and Casting of Lead and Lead Alloys," "Magnesium Sand Foundry Practice," "Permanent Mold Casting of Magnesium Alloys," "Casting of Magnesium Ingots for Working," "Melting and Casting of Nickel and Nickel Alloys," "Casting of Tin and Tin Alloys," "Casting and Production of Zinc Alloys," "Melting Precious Metals," "Jewelry Casting," "Cast Alloys," "Wrought Aluminum Bronze," "Steel Castings," "Stainless Steels and Heat-Resistant Alloys," "Heat-Resistant Castings," and "Austenitic Manganese Steel."

Up-to-date revisions of many sections which appeared in the 1939 edition can be found in the latest book. These sections deal with cast iron, malleable iron, acid electric steel melting, and many other operations and materials of foundry and metallurgical interest.

Other sections of general interest describe mechanical testing, nondestructive testing, pyrometry, refractories, heat treatment, and metallographic examination.

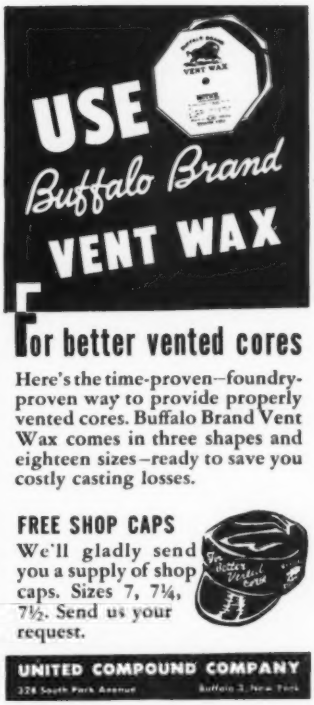
The 1948 *Metals Handbook* is probably the largest and most diversified collection of metal fabricating and metallurgical information available in a single volume.

*Experimental Casting Plastics*, by Thomas A. Dickinson. 33 pp. Price $2.00. Published by Plastics Research Co., P.O. Box 346, Alhambra, Calif., (1947).

A practical survey of plastic casting materials and techniques treating of the elemental problems in designing, constructing, and using patterns, molds, and casts. The illustrations and schematic views make the book especially valuable for the beginner.

Titles of books, pamphlets, and names of manufacturers of products mentioned in the text are included immediately following their particular application.

Resin manufacturers with names of products, books on plastic molding, and magazines on the subject are listed at the end of the book.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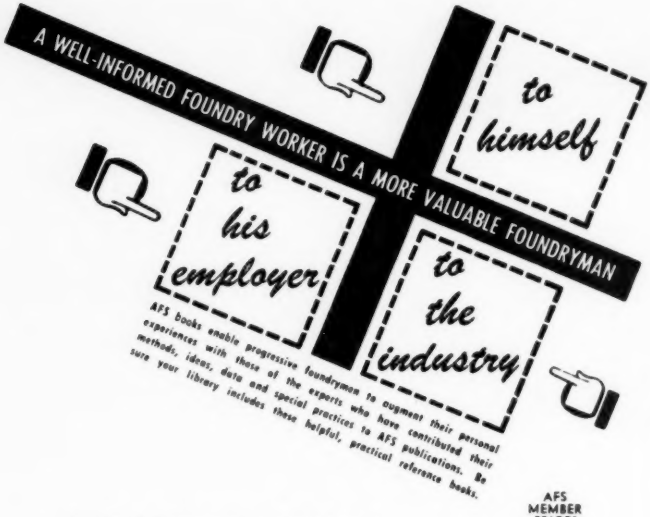
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## CHAPTER ACTIVITIES

*(Continued from Page 72)*

iems with members of the audience. William B. Ziegelmueller, vice president of Electric Steel Castings Co., Speedway City, presided.

At a meeting of the board of directors, held prior to the regular meeting, Robert Spurgin, foundry superintendent, Swayne, Robinson & Co., Richmond, was elected a chapter director to fill the unexpired term of Fred Carl, foundry metallurgist, Central Foundry Division, General Motors Corp., Danville, Ill., who transferred to the Central Illinois chapter.

### Chicago

**George J. Biddle**
**Illinois Clay Products Co.**
**Chapter Reporter**

ANNUAL LADIES' NIGHT of the Chicago chapter will be held Saturday evening, February 19, at the Palmer House. Tickets and reservations are available from Harry Cullen of the Carnegie Illinois Steel Corp., South Works.

The first meeting of the New Year was held January 3 at the Chicago Bar Association. Chapter President Chester K. Faunt, Christensen and Olsen Foundry Co., presided. The meeting was devoted to group round tables.

For the Malleable Group, R. L. McIlvaine, National Engineering Co., provided a running commentary on the industrial motion picture, *"New Foundry Horizons"*. R. P. Schauss, Illinois Clay Products Co., directed the meeting.

*"The Effect of Additions on the Fundamentals of Steel Making—Ladle versus Furnace"* was the subject for the Steel Group. Speakers were P. J. Neff, American Steel Foundries, and C. F. Christopher, Continental Foundry & Machine Co., and discussion leaders were R. E. Kerr, Pettibone Mulliken Co., and E. H. Weak, American Steel Foundries.

A. C. Den Breejen, Nichol-Straight Foundry, was speaker for the Gray Iron and Pattern Group. His subject was *"What I Want in a Pattern"*. J. J. Schallerer, Calumet Pattern Works, was chairman.

In the Non-Ferrous Group, Albert Retis, Stanal Aluminum Foundry Co., spoke on *"Aluminum Founding"*. Chairman M. G. Dietl, Crane Co., presided.


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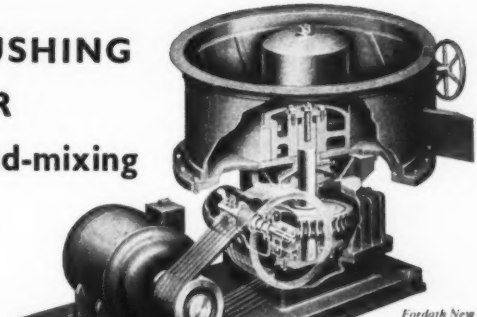

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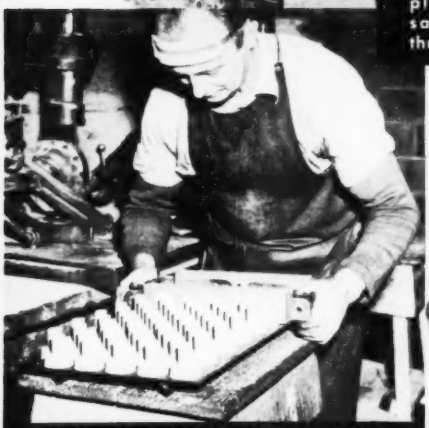

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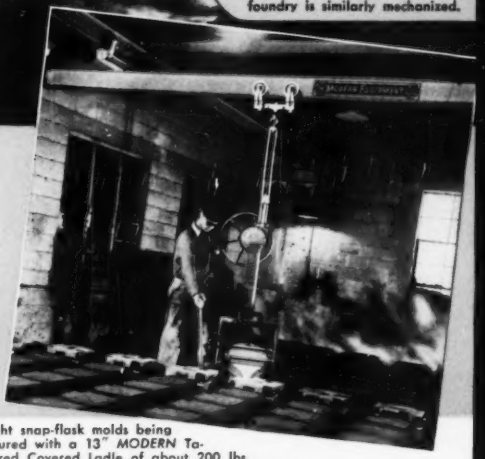
# 60 Tons Per Day The MODERN EQUIPMENT COMPANY Way

**at J. E. Gilson Co. Foundry**



Light snap-flask molds being poured with a 13" *MODERN* Tapered Covered Ladle of about 200 lbs. capacity mounted on a MODEL F Pouring Device.

## ...thru Efficient Mechanized Distribution and Pouring of Molten Metal

The pictures on this page were taken in a foundry mechanized for high production pouring by the installation of properly engineered MODERN EQUIPMENT. Superstructures, runways, cranes, hangers, pouring devices, pouring ladles and distributing ladles . . . all bear the MODERN Trade Mark.

The MODERN EQUIPMENT CO. offers foundrymen the benefit of its long and varied experience in the engineering and production of equipment for complete mechanization of metal pouring and distributing operations.

***Ask Your MODERN Representative or Write for Illustrated Bulletins***

Partial view of squeezer floor operation shown in top picture. Molders pour their own molds with *MODERN* Ladles and Pouring Devices suspended from *MODERN* Cranes and Runways. The result is higher mold production.

MODERN EQUIPMENT CO.

PORT WASHINGTON, WISCONSIN

**CUPOLAS • CUPOLA CHARGERS • LADLES OF ALL TYPES • POURING DEVICES • METAL POURING SYSTEMS • CRANE AND MONORAIL SYSTEMS • ELECTRIC CRANES.**